

HIGHER PRODUCTIVITY AND LOWER COSTS FOR CHEMICAL PROCESS INDUSTRIES IS THIS MONTH'S REPORT SUBJECT

A McGraw Hill Publication

Fifty Cents





18-inch standard weight Tube-Turn welding tee and pipe laid out preparatory to assembly for hydrostatic pressure test.



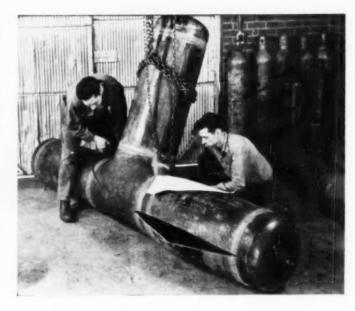
Welder completing last bead in assembly. Fitting and pipe now form homogeneous, leakproof unit.



Assembly is hung in pit, massively lined with concrete. During test top grating is closed and held down by a barricade of sandbags.



Final result after hydrostatic pressure test. The straight pipe burst first, and the tee is undamaged.



Strength through Design in Tube-Turn welding fittings

## The pipe burst first!

Take an 18-inch standard weight welding tee. Take three corresponding lengths of pipe. Weld tee and pipe together. Cap the ends. Lower the assembly into a pit. Then apply hydrostatic pressure—much more than the assembly is supposed to take!

Something has to give! According to the accepted beliefs it should be the tee. But not in the case of the test pictured here. The Tube-Turn "barrel-shaped" tee was used—and the pipe burst, well before the tee was affected! Throughout numerous tests, this new type of tee has withstood at least 25 per cent more pressure than required by the formula given in ASA B16.9.

The superior strength of the tee was achieved without running up extra weight and cost, by carefully planned improvements in shape (based on the sphere, nature's



strongest form for internal pressure), and by a carefully engineered distribution of metal.

This is a typical example of strength through design in Tube-Turn welding fittings, and another good reason why leading piping engineers specify Tube-Turn equipped, welded piping.

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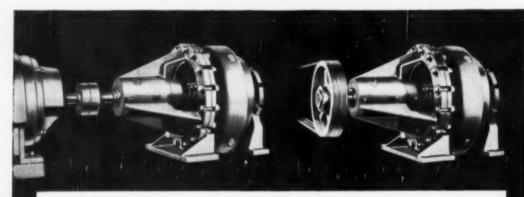
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# Solve Fluid Flow

WITH THESE ALLIS-



#### These Solids Pumps Look Alike, but...



#### THE "PW" IS FOR CORROSIVE FLUIDS

Working parts of direct-driven PW solids pump are made of special alloys designed for maximum resistance to corrosion. These Allis-Chalmers pumps handle a wide range of chemical pulps and liquors with negligible dilution from sealing water,

- Has special corresion-resistant allay parts.
- Designed for direct-drive, motor or engine. Handles up to 40% solids in suspension.
- Only 5 major parts high accessibility. 175 to 8,000 gpm; heads to 140 ft.

Send for Bulletin 08B7112.



#### THE "CW" IS FOR **ABRASIVE FLUIDS**

Working parts of CW solids pump are made of Alligine alloy, an extremely hard, non-machinable alloy that offers remarkable resistance to abration. Effective in handling slurries, tailings, sludges. Delivers near-rated capacity until parts are completely worn out.

- Has hard Allisite allay working parts.
- Driven through Texrope V-belt drive and motor,
- Also handles up to 40% tolids.
  Parts accessible without disturbing piping. Parts accessible without disrutuing p

Send for Bulletin 08B6381B.

PROFITABLE SOLUTIONS to your fluid handling problems depend on getting the right pumps specified for your job in the first place. Then your pumps will deliver rated capacity month after month . . . and you'll have better control of your fluid flow operations.

Insist on getting top value in terms of durability when buying pumps. The centrifugal pumps shown here are excellent examples of sound pump design . . . with strength features that "pay off" in long, reliable service.

Another important thing - get pumps that are easy to install and maintain. Here too, you'll find Allis-Chalmers offers pumps designed for ease of packing . . . ease of disassembly . . . ease of replacing standard parts.

Find out more about this modern pump line from the A-C representative in your area.

October 1949-CHEMICAL ENGINEERING

## Problems CHALMERS PUMPS



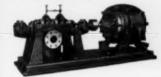
OTHER ALLIS-CHALMERS
CENTRIFUGAL PUMPS FOR
THE CHEMICAL INDUSTRY



SINGLE SUCTION has mounted and closecoupled type pumps. Either type available of special alloy construction for corrosive liquids. Bulletins 52B6351A and 52B6140A.



SINGLE STAGE double suction, split casing pumps. Can be constructed of many special machinable alloys. 30 to 170,000 gpm; heads to 475 ft. Bulletin 08B6146.



MULTI-STAGE pumps for high pressure systems. Constructed of materials to suit application in 2 to 7 stages for capacities up to 10,000 gpm and heads to 2,000 ft.



SELF-PRIMING pump has rapid, automatic priming action. Full capacity after 3 minutes operation on a 20 ft suction line. Sizes to 350 gpm; heads to 300 ft. Bulletin 08B6319B.



A-2723

PEDRIFUGAL Economy pump for

average requirements up to 500 gpm; 100 ft heads.



Yearape, Pedrifugal, Allisite are Allis-Chalmers trademorks.

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Send for Bulletin 08B6615A.

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ing capacity and head.

15 to 1,300 gpm; heads to 275 ft.



## This AO Acetate Safety Goggle

GIVES CHEMICAL WORKERS <u>SPARKLESS</u> PROTECTION AGAINST FLYING PARTICLES

#### QUICK FACTS

<sup>6</sup> & Curve Super Armorphate lenses, Clear or Calobar in 3 shades.

"Acetate side shields, perforated to minimize fagging of lenses and for ample ventilation. "Lightweight strong keyholo bridge.

\*Hinges and temples out of line of sight.

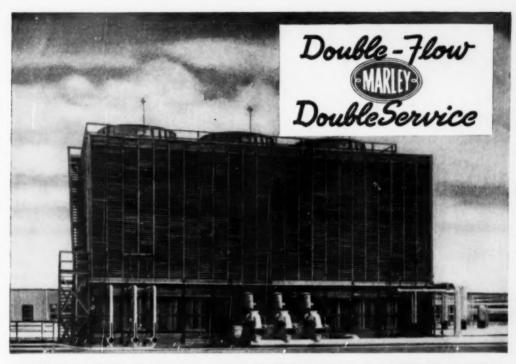
\*Nose pads distribute goggle weight evenly for comfort.

It's good looking. It's light. It's strong and durable. And important to chemical workers, sparks due to flying particles can't endanger because the frame of the AO 9249 is made of nonflammable cellulose acetate. Call your nearest AO Safety

Products Representative or write.



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#### FOR THOSE "EXTRA TOUGH" WATER COOLING JOBS

MARLEY DOUBLE-FLOW COOLING TOWERS are built to "Take It"! For unusually heavy water cooling requirements . . . open, closed or combination cooling . . in any kind of weather . . . and in abnormally corrosive atmospheres, the MARLEY DOUBLE-FLOW is designed to give consistent, around the clock service with a minimum of maintenance time and expense.

This is true because MARLEY DOUBLE-FLOW has these outstanding, exclusive features:

**OPEN DISTRIBUTION SYSTEM...** On top of the tower, in plain view, easy to inspect, regulate and clean.

NO DEAD AIR POCKETS... Every drop of water meets a steady flow of air as it splashes down thru Marley's patented nail-less filling.

BETTER MECHANICAL EQUIPMENT . . . Equipped with Marley engineered and Marley made fans, fan cylinders, drive shafts and Geareducers . . . your assurance of top quality.

**SOUND STRUCTURES** . . . Double-Flows have withstood hurricanes, earthquakes and corrosive atmos-

pheres because all lumber, hardware, supports, bracing and columns are designed to make an engineered structure.

COMPLETELY SAFE OPERATION...Stairways, handrails, walkways, and fan cylinders insure safe operation and maintenance in any kind of weather.

MINIMUM DRAFT LOSS . . . Drift eliminators set in slanting position allow greater area for air passage, minimizing draft loss and reducing horsepower requirements.

**GREATER COOLING CAPACITY...** Packed with decks of nail-less filling, Double-Flows have more wetted surface therefore greater cooling capacity.

If you're looking for GREATER SERVICE, LOWER COST and IMPROVED WATER COOLING EFFI-CIENCY in your plant, be sure to ask a MARLEY "Double-trained" APPLICATION ENGINEER to an-

alyze your situation and recommend the COOL-ING TOWER you need to meet your requirements. There's no cost or obligation.

Photo by Elwood Payne



THE MARLEY COMPANY, INC. . KANSAS CITY 15



#### Check what the users say against the Benefit Points Below

· A Rubber Goods Manufacturer says "We have used these Type 1000" valves for several years with fine results on air or water service at pressures from 10 lb. to 300 lb. service at pressures from 10 lb. to 300 lb. depending on requirements. These valves as claimed have been found to have LARGE CAPACITIES. On FLUCTUATING LOADS or STEADY LOADS they are MOST DEPENDABLE, RAPID IN ACTION with a QUICK DEMAND and TIGHT CLOSING when the load drops off. They require but a MINIMUM OF SERVICE OR MAINTENANCE."

 A Chemical manufacturer says—
"The CASH STANDARD Type '1000' valves which we have in service have fulfilled the conditions checked ... (ACCURATE PRESSURE CONTROL UNDER TOUGHEST WORKING CONDITIONS), (TROUBLE FREE SERV-CONDITIONS), (TROUBLE FREE SERV-ICE), (TIGHT CLOSURE) better than any other steam pressure reducing valves that we have used."

WRITE FOR BULLETIN 962

CASH STANDARD CONTROLS ...

VALVES.



TION. Maximum capacity when needed most.

"We have had a number of your CASH STANDARD Type '1000' valves in operation in

our plant for a number of years. These valves have proved to be satisfactory in every respect. We particularly like this type of valve because it is SIMPLE TO INSTALL, REQUIRES A

MINIMUM OF MAINTENANCE, and gives CONTINUOUS and UNIFORM PRESSURE

A Plant Engineer says—
"We find that the CASH STANDARD Type

1000' streamlined valves are best suited for our various applications of compression mold-ing because of their VERY WIDE RANGE OF

ACCURATE PRESSURE CONTROL. The sim-

plicity of construction of these valves has kept the MAINTENANCE COSTS VERY LOW which of course means a SAVING IN COST OF OPERATION, and SPEEDIER PRODUC-

Accurate pressure control under toughest working conditions. Trouble-free service.

Smooth operation.

Tight closure.

CONTROL.

Speedier production results.

Elimination of failures.

Cost-saving operation.

10. Practically zero in maintenance.

A. W. CASH COMPANY DECATUR, ILLINOIS

RULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES Send for them

4



Bulletin 950-features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Elupprint shows simplicity of installation.



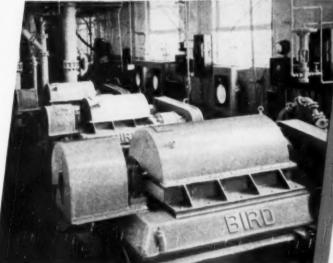
Bulletin 956-features the CASH STANDARD Type 4030 Back Pressu Valve - designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Frean Gas Capacity Chart based on ABSOLUTE pressures



Bulletin 966-features the CASM STANDARD Self Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air, with any gas or oil that is non-corrosive, and with refrigerating fluids such as Ammonia and Freen. Many interesting particulars explained such as how valve works, tight seating, large capacity, no waste, no water hammer or chatter.

## BETTER BUY BIRDS

-if you want to save money



Bird Filters have been replacing older, slower, more cumbersome filtering methods to get a better product and more of it per day — but not until after they have been operating for a while do many of their users discover that the BIRD not only does it better and faster but at lower cost.

Here are some of the savings. Under present competitive conditions, what would they mean to you?

BIRD

CONTINUOUS CENTRIFUGAL FILTER

NTRIFUGAL FILTER

BIRD MACHINE COMPANY . SOUTH WALPOLE, MASS.

## YOU SAVE ON Operating Costs

Bird filtration is fully automatic and continuous - automatic loading and automatic timing. No operating attendance required.

#### YOU SAVE ON Maintenance Costs

No filter cloths, no filter medium — nothing to clog or replace. Check-ups ance or twice a year are generally all that is required.

#### YOU SAVE ON Extra Equipment

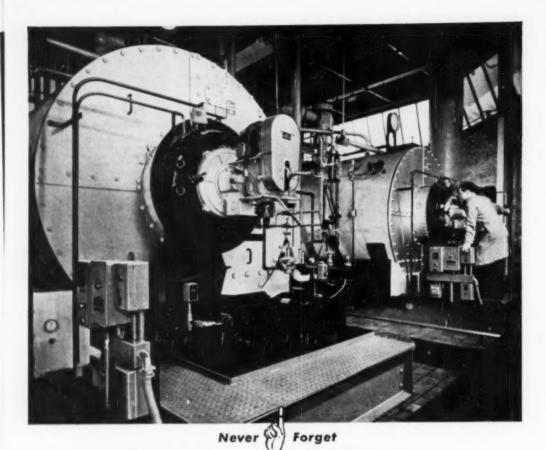
No vacuum; no auxiliary handling equipment needed. Feed sturry may be thick or thin, often eliminating an extra operation.

### YOU SAVE ON Aloor Space

The Bird is completely selfcontained. It is available in a wide range of sizes, even the largest requiring only a few square feet of floor space.

#### YOU SAVE ON Storage Space

Separation of solids from liquids is quick — average retention in the Bird about a minute. No need for storage before filtration.



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Yes — generating steam costs money — money for fuel, boiler operation, care and maintenance. An old or outmoded fuel-wasting boiler can burn many hidden dollars through excessively high steam costs.

It's sound business to install boilers that give you the most for your steam dollars — modern, guaranteed high efficiency Cleaver-Brooks boilers, using oil or gas as fuel.

For any boiler installation (15 to 500 HP.)—new or replacement—Cleaver-Brooks offers these immediate and long-range cost-saving advantages:

A Custom-Planned Boiler Engineered for Your Needs: Your steam needs and steam-using equipment are studied — your present steam load

plus your estimate of future expansion are considered — with this information the size of Cleaver-Brooks Boiler best suited to your specific needs is determined.

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In addition, Cleaver-Brooks boilers

give you clean, smokeless operation eliminate fuel and ash handling — require no high or costly stacks — no special foundations — fit under low headroom — provide quick steaming, flexible operation to meet fluctuating loads — fully meet all codes. Available in sizes 15 to 500 HP., 15

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WRITE on your business letterhead for Steam Cost Calculator—



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## NO DOUBT!

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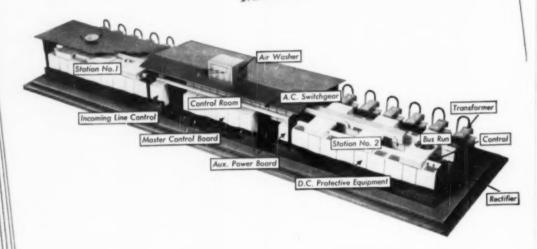
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## I-T-E opens its order book for a PREVIEW OF

featuring the new 1-T-E Low Voltage

Mechanical Rectifier





Reduced installation cost. Unit-assembly at the factory makes it possible to deliver the equipment as a complete "package."

## TOMORROW'S RECTIFIER STATION

• Here it is! — the first functionally planned rectifier station . . . a complete installation built around I-T-E's new Mechanical Rectifier!

This equipment is now being built at I-T-E. When completed, the installation will consist of two rectifier stations, each delivering 24,000 amperes - one at 200 volts, and the other at 325 volts.

#### NOTE THE MANY FEATURES OF THIS MODERN STATION:

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Drawout-type a-c protective switchoperator. gear is also in the central location, convenient to the rectifier control board.

I-T-E Mechanical Rectifiers and the controls for individual units are completely

The overhead bus carrying the d-c power enclosed in metal. from the rectifier to the d-c switchgear is completely metal-enclosed.

#### NOTE THAT IT WAS NOT NECESSARY TO PROVIDE OVERHEAD CRANE SPACE:

I-T-E Mechanical Rectifiers can be moved easily and quickly on their own wheels, as can the I-T-E a-c and d-c drawout breakers. Complete mobility of I-T-E units eliminates the need for overhead crane facilities and makes it possible to use the space for bus runs.

The I-T-E equipment for this station will be delivered to the installation site as packaged units—completely assembled, wired, tested, and ready to connect!

#### Get the complete story . . .

1-T-E Bulletin 4809 contains complete technical information on the I-T-E Mechanical Rectifier, as well as a detailed pressentation of its operating principles. Send for it today!





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## MECHANICAL RECTIFIERS

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PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.



#### -another advance through

#### **Swenson Process Engineering**

A recent Swenson development is this special evaporator for producing solid caustic soda in a single pass, using 50%-75% chlorate-free feed liquor. The equipment is compact and requires little space.

Heating with dowtherm vapor,

operation is continuous and extremely simple. Over-all cost is low compared with conventional caustic pots. Results already obtained indicate savings of up to \$2.50 per ton of NaOH. Information will be sent on request.

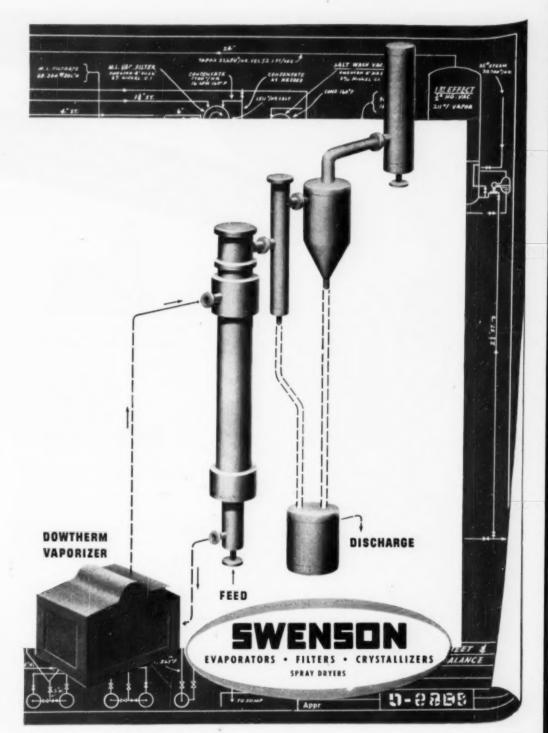
Perhaps you have problems of evaporation, concentration, crystallization, filtration, or spray drying with which Swenson engineers can help you. Your inquiries are welcome.

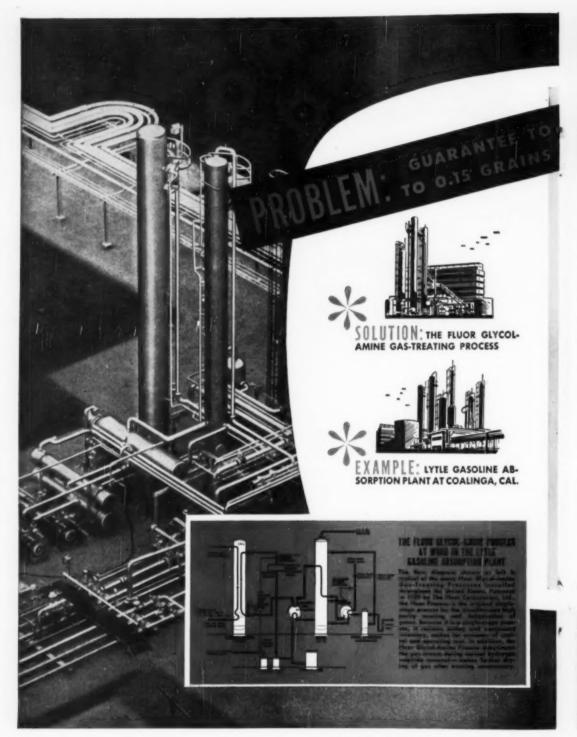
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Division of Whiting Corporation

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Can Kemp help you offset the Gas shortage

The gas shortage will be less acute if you get more efficiency from the gas you buy.

Kemp Carburetors put the last BTU from a given quantity of gas right at the point of action. Moreover, they give you automatic control, run years without maintenance, need no labor to operate.

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Diagram shows principle of Kemp Industrial Carburetor Stide-valve. Top slide moves in direction A-A to increase or decrease volume in response to demand. Moves in direction B-B by micrometer gage adustment to vary proportions of gas and sir.

## KEMP of BALTIMORE

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The C. M. Kemp Manufacturing Co.

405 East Oliver Street

Baltimore 2, Maryland

Please send me your NEW Bulletin No. IC-22 on Industrial Carburetion.

Please send a Kemp representative in to see me.

Name

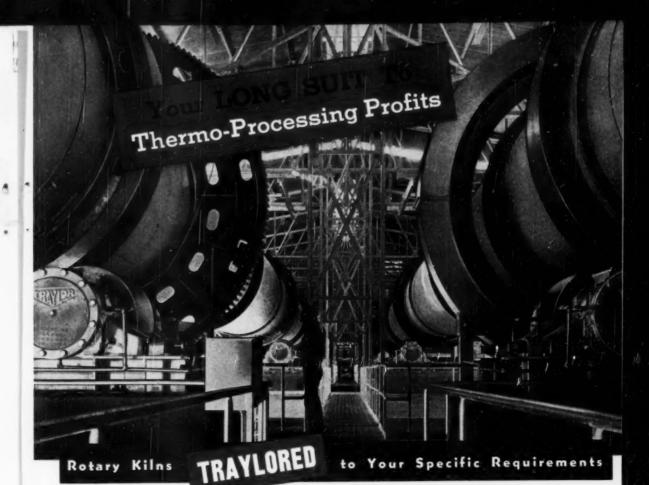
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Every Traylor kiln has been constructed for a specific operation. During Traylor's more than 40 years of experience, this policy has ensured the greatest possible thermo-processing profits for many of the World's leading cement, lime, and chemical process plants. Only after every factor has been analyzed—raw materials, product characteristics, desired capacity, peak load anticipated, fuel available, space for installation, to mention some—is a kiln TRAYLORed for the job . . . constructed for peak profit capacity.

## TRAYLOR KILNS REQUIRE LESS POWER ...LESS MAINTENANCE

The unusual strength and rigidity of Traylor all-welded steel kiln shells make Traylor kilns easier to align and keep in alignment. Traylor kilns require less power for turning . . . have lower maintenance costs. All controls are centralized to put every phase of kiln operation under the eye and control of the operator.

Write today for detailed information on Traylor's many structural advantages. Ask for Bulletin 115.

#### TRAYLOR SLURRY FEEDERS

#### For Accurate Feed Control

A Traylor Ferris Wheel Type Slurry Feeder is comprised of a steel disk-wheel rumed with buckets, a constant level tank and a proportioner which diverts the flow of wet material at any desired rate. No equipment offers more accurate feed control to your kiln, mill or dryer. Sizes: 3' to 6'.



#### TRAYLOR ENGINEERING & MANUFACTURING CO. — 191 Mill St., Allentown, Penns.

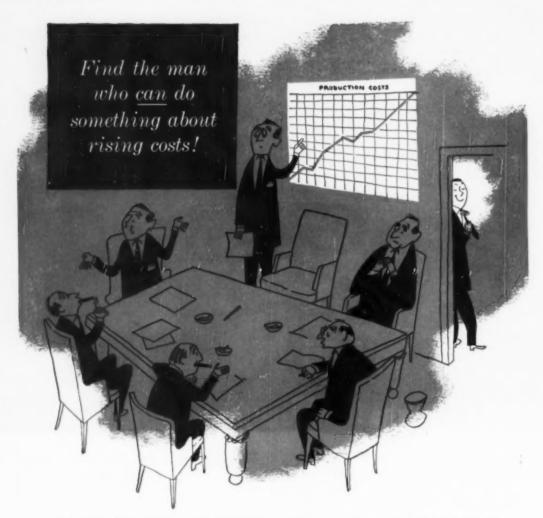
Canadian Mfr: Canadian Vickers, Ltd., Montreal, P.Q. Sales Offices: New York, N. Y., Chicago, Ill., Los Angeles, Calif.

CRUSHERS - GRINDING MILLS

ROTARY KILNS

ROT

A "Traylor" Leads to Greater Profits



In most businesses, operating costs are still on the rise. But there's one man who can do something about it—he's the man whose job is to get maximum heat and power from fuel dollars. He knows you get maximum efficiency from Eagle-Picher Industrial Insulations because they're made of durable, chemically and physically stable mineral wool, noted for its low conductivity. They give long years of service and are easy to maintain and replace.

There's an Eagle-Picher insulation that can help reduce your operating expenses!

Let these Eagle-Picher products also save you money . . . power . . . time

Insulating Felts
Supertemp Block • Blankets
Loose Wool • Pipe Covering
Stalastic • Insulseal • Insulstic
Swetchek • Finishing Cements
Insulating Cements

#### THE EAGLE-PICHER COMPANY

General Offices: Cincinnati (1), Ohio

Insulation products of efficient mineral wool—for a full range of high and low temperatures. Technical data on request.



Since 1843

22

The perfect answer

# FOR MAXIMUM FUEL SAVINGS AND EXACT TEMPERATURE CONTROL

For a completely effective, low-cost insulation combination, you can't beat the teamwork of Eagle-Picher Mineral Wool Blankets, Supertemp Blocks, Super "66" Cement and Insulseal. They work effectively to give your equipment higher efficiency...cut operating costs...and help to provide perfect, precise control over temperatures.

Visit Booths 67s and 679 at the Chemical Show in New York November 28 to December 3







#### EAGLE-PICHER MINERAL WOOL BLANKETS

These blankets satisfy the need for a convenient method of quickly and efficiently insulating flat or curved surfaces on larger types of heated equipment. Mineral wool is felted and secured between flexible metal fabric. Outstanding physical and chemical stability enable Eagle-Picher Blankets to resist water, steam, corrosive fumes and normal vibration.

#### EAGLE-PICHER SUPERTEMP BLOCKS

Eagle-Picher Supertemp Blocks are lightweight (approximately 16 lbs. per cu. ft.). Can be cut easily with knife or saw to fit off-shaped areas . . . they fit snugly over minor irregularities. They're strong and have high refractory value. Withstand temperatures up to 1700 F. Conductivity at 512 F. approximately 0.43...all standard sizes, from 3" x 18" to 12" x 36" . . . in thicknesses from 1" to 4".

#### EAGLE-PICHER SUPER "66" INSULATING CEMENT

Super "66" is all-purpose, rustinhibitive, extremely adhesive insulating cement. "Springy ball" pelletsdon't collapse after application... give great coverage, retain their thermal efficiency. 100 lbs. covers 65 sq. ft. —1 inch thick! Easily applied with trowel, over flat and irregular surfaces. Efficient for temperatures up to 1800 F. Reclaimable when used on equipment whose temperatures go up to 1200 F.!

#### EAGLE-PICHER INSULSEAL

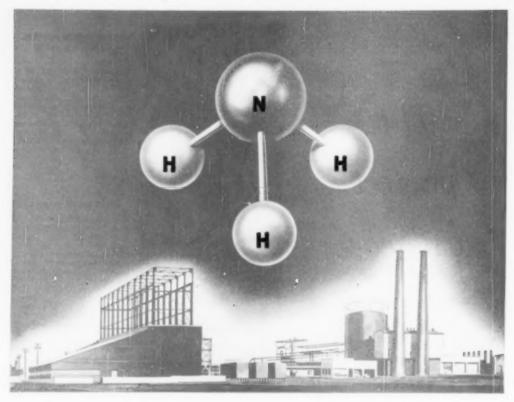
A tough, weatherproof, protective coating for insulation. For temperatures up to 450 F. Applied as a plastic, its smooth troweling qualities assure uniform coverage, proper thickness. It protects insulation from air infiltration, fumes, rain, snow, vibration, punctures, and withstands severe service, indoors or out. Dries to a smooth, rich black, has a neat appearance on hot or cold surfaces... may be washed or painted.



Insulation products of efficient mineral wool—for a full range of high and low temperatures. Technical data on request.



Since 1843



## THINKING Synthetic Ammonia?

3,953 tons per day! That's the total rated capacity of 44 synthetic ammonia installations completed or currently being constructed throughout the world by Chemico. Here are four major reasons why so many large producers of synthetic ammonia look to Chemico:

Chemico-built plants employ the well-known N. E. C. Process which can be adapted to use any available source of hydrogen, i.e. from electrolytic cells, semi-water gas from coke and natural gas as well as from coke oven gas, gas from lignite or by-product hydrogen from electrolytic chlorine cells or

fermentation processes.

- The gases for the production of ammonia are thoroughly purified before being introduced into the synthesis system. This accounts for the continuous service and long life of the catalyst...important factors in assuring low ammonia costs.
- The temperature of the highly active, extremely rugged catalyst is kept at a constant optimum. This avoids overheating portions of the catalyst mass, with a consequent loss of activity.
- 4. Chemico plants are designed to operate

at pressures high enough to effect maximum economy, but which permit the use of conservative safety factors, high efficiencies and simple, economical designs.

No matter what your synthetic ammonia requirements . . . whether you plan to build a new plant or remodel an old one . . . it will pay you to investigate thoroughly all the advantages Chemico offers. Chemico's unmatched record of experience in designing and constructing heavy chemical plants is your best guarantee of profitable performance. Write today for Chemico Bulletin A-101.

#### CHEMICAL CONSTRUCTION CORPORATION

EMPIRE STATE BLDG., 350 FIFTH AVENUE, NEW YORK 1, N. Y.

EUROPEAN TECHNICAL REPRESENTATIVE

CYAMAMID PRODUCTS, LTD., BRETTERHAM HOUSE, LANCASTER PLACE, LONDON W. C. 3, ENGLAND
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HYDRO-NITRO S. A., 8 QUAI DU CHRVAL BLANC, GENEVA, IWITSERLAND

CABLES: CHEMICONST, NEW YORK



Chemica Plants are profitable investments

00184



N Bombay as well as Brussels—in Rio as well as Rotterdam-customers know they can count on Maritime's years of experience to produce high-grade lubricating oil. And they know, too, that Maritime will deliver that oil-no matter how many miles it travels-in exactly the same quality and quantity that leaves the plant in Houston. For every gallon of Maritime -Texas Special, Red Eagle, Blue Pennant and Marco-is packaged in drums equipped with Tri-Sure Closures.

The Maritime Oil Company is using a sure means of maintaining customer confidence all over the world-because they are using drum closures that function with unfailing efficiency to prevent leakage, seepage, pilferage and

substitution. Tri-Sure Closures have a flange that is an integral part of the drumhead . . . a plug that screws securely in place . . . and a leakage-proof, heavy-gauge seal which cannot be removed unless it is deliberately destroyed.

Again and again, the experience of leading shippers has demonstrated that it always pays to give fine oils and chemicals the protection of Tri-Sure Closures. It will pay you-in pleased customers, in product security, and in protec-

tion to your reputation-to specify "Tri-Sure Closures" on every drum order.

\*The "Tri-Sure" Trademark is a mark of reliability backed by 27 years serving industry. It tells your customers that genuine Tri-Sure flanges (inserted with genuine Tri-Sure dies), plugs and seals have been used.

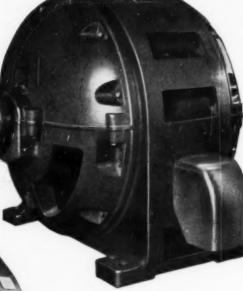


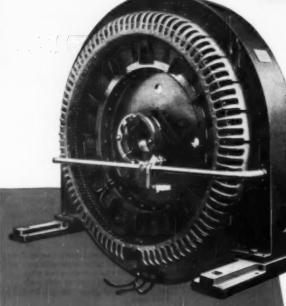
CLOSURES

AMERICAN FLANGE & MANUFACTURING CO. INC., 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y. TRI-SURE PRODUCTS LIMITED, ST. CATHARINES, ONTARIO, CANADA

# SAVE ON POWER BILLS

TRI CLAD HIGH SPEED
SYNCHRONOUS MOTOR





LOW SPEED
SYNCHRONOUS MOTOR

# SYNCHRONOUS MOTORS

#### SYNCHRONOUS MOTORS IMPROVE POWER FACTOR

- Save you penalty charges for poor power factor
- 2. Release needed generating capacity

#### Here's an example:

One mill improved power factor from 72 per cent to 84 per cent by installing a 300 hp. 8 leading power factor G-E synchronous motor in place of another motor. This corrected power factor released 260 kva capacity in their generating equipment and allowed installation of additional motors.

These savings in cost of operation are available to you.

Savings in the initial cost of equipment are also available—when synchronous motors are used in their natural fields of application. To find out about these natural fields of application, get in touch with our nearest office.

REMEMBER—General Electric Synchronous motors—whenever you need constant speed. They can give you lower initial cost, lower operating cost. For bulletin information, fill in the coupon: G-E SYNCHRONOUS MOTOR CONTROL

#### MAKES SURE

G-E synchronous control provides the occurate adjustments that enable you to improve power factor. Here's where details count—where the slightest variation of a pointer on a meter means money sured—or lost. And General Electric has not overlooked these elements. Consider the meters for a moment. Here, G-E has devised a long scale with the pointer in the same plane us the figures so there can be no possibility of misreading the liestrument. Anti-glare glass is used so no distortion is possible.

The new smaller rheostat, too, has design features that not only result in longer life but in greater operating convenience and accuracy. The handle has been molded to fit the fingers of the operator—to prevent slippage and over correction. You can be sure, too, that the new field circuit will respond instantly to rheostat adjustment.

Protection is assured the operator through the attractive steel enclosure. The cabinet resists blows, keeps out dirt and other operating housets. All live ports are strongly guarded. Plant appearance is improved with this control designed to line up with other CE-power units such as switchgear. Ask your nearest G-E office for more information about this equipment that safeguards your investment ... helps save aperating expenses.



|    | Apparatus Dept., Sec. E770-6, General Electric Company 1 River Road, Schenectady, New York   |
|----|--|
|    | Bentlemens Please send mes:  GEC-595, Synchronous Mater Control GEA-5113, High-speed Synchronous Motors Company Name City Street State |
| GE | NERAL & ELECTRIC   |



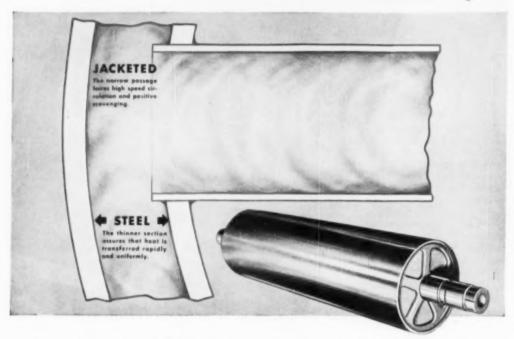


## YOU GET MORE

HEATING DRYING CHILLING CRYSTALLIZING HARDENING

## OUTPUT

## from steam (or coolant) this way



Lukenweld Jacketed Steel Rolls move heat rapidly—in or out. Their welded steel plate construction permits thin sections. Whether the task is heating or chilling, surface temperatures are more uniform and constant.

High steam pressures are employed with safety with Lukenweld Rolls. Records covering dozens of installations in a variety of industries show production increases of more than 60% over old style rolls. Bulletin 358 tells you more about them.

If you're interested in learning what Lukenweld Jacketed Steel Rolls will do for you, if you're needing an addition to present equipment or a complete new machine, get in touch with us. Lukenweld, Division of Lukens Steel Company, 400 Lukens Building, Coatesville, Pennsylvania.

LUXENS

LUKENWELD

DIVISION

Come see us at the Metal Show in Cleveland, October 17-21, Booth 503, and the Chemical Show in New York, November 28-December 3, Booths 558-563.

DESIGNERS, ENGINEERS AND MANUFACTURERS OF MACHINERY



#### ROBINS HYDREX SCREENS LICK STREAM POLLUTION PROBLEM FOR CANNERIES

Cannery men, among others, have discovered that you can separate solids from liquids quickly and easily with Robins Hydrex Screens.

In order to avoid stream pollution they simply hose peelings, rind and other waste down through floor troughs that lead to Robins Hydrex Screens. These proved vibrating screens then process the fluid, creating a clear effluent and sending the solids to a disposal chute or belt.

Of course, your job of separating solids and liquids may be different from this example. But you'll find you can do it better with Robins Hydrex Screens. You can use them to

- 1. Save liquids from solids
- 2. Save solids from liquids

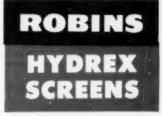
3. Remove fines from coarser materials

Furthermore, Robins Hydrex Screens assure you of continuous operation. That's because the high-speed vibrations of these screens produce a self-cleaning, self-discharging action.

You can get Robins Hydrex Screens in floor-mounted or suspended types, and in models to handle hot or cold materials, acid or alkaline.

Why not investigate Hydrex Screens for your work?

SEND TODAY for the story of how your screening problem can be solved with Robins Hydrex Screens. Address Robins Conveyors Division, 270 Passaic Avenue, Passaic, N. J.



HEWITT-ROBINS products for all your materials-handling needs!

Rebins Conveyors Division; Screens, Idlers, Conveyors, Shakeouts. Hewith Rubber Division; Industrial Hose, Conveyor Belt, Transmission Belt. Rebins Engineers; Complete Bulk Materials-Handling Systems.

ROBINS CONVEYORS DIVISION HEWITT-ROBINS INCORPORATED



SENSITIVITY EVEN ON WIDE



scause this Potentiometer has NO SLIDEWIRE

Here is the heart of Dynalog Instruments . . . the "Dynapoise Drive", Its simple, variable capacitor eliminates the friction and turn-to-turn skips of the conventional slidewire.

With full sensitivity on wide scales (as well as narrow ones), Dynalog\* Electronic Recorders and Controllers at last make it possible to select chart ranges that cover shutdowns and other process extremes. No longer is it necessary to compromise accuracy in order to get complete chart records of an entire process cycle.

The unique, radio-type capacitor of Dynalog Instruments gives them three times the sensitivity of previous instruments for the same jobs (1/100 of 1% of scale). It provides absolutely stepless, continuous balancing, free from turn-to-turn limitations of a slidewire.

This and many other advantages of these electronic potentiometers are results of full and skillful use of electronic methods which eliminate mechanisms found in conventional bridge-type instruments. Dynalog Instruments are available for measuring and controlling temperatures (with thermocouples or resistance bulbs), humidity, pressure, flow, force, etc. Get the complete story in Bulletin 427. Write The Foxboro Company, 16 Neponset Avenue, Foxboro, Mass., U. S. A.

#### DYNALOG® SIMPLICITY that means PRACTICALLY NO MAINTENANCE

. No slidewire . No moving contacts . No high-speed motor . No galvanometer . No standardizing . No gears or cables . No knowledge of electronics needed . Only occasional replacement of standard radio tubes required . Impossible to over-range

\*Reg. U. S. Pat. Off.

ELECTRONIC DYNALOG

INSTRUMENTS

## How to be Right the first time

#### WHEN SELECTING STEAM TRAPS

APPLICATION

No single type of trap is suitable for all applications. But one of the four distinct Sarco types will be exactly right for any given application. Some provide quicker warm ups in the morning, some extract more of the heat, some are better for fluctuating condensate loads and others are better for out of doors. Sarco has the only plant devoted exclusively to complete lines of steam traps and temperature controls. To be sure, the first time, see Sarco first.

#### THERMOSTATIC

Wide open when cold for quick starts.

Retains more of the heat before releasing condensate, Large valve orifice
purges air quickly when starting. No
seat changes when pressures change.
Cannot freeze. Two types-for low pressure heating and high pressure industrial service up to 300 psi. Bulletin No.
250.



#### FLOAT

Ball float allows continuous discharge without shock to temperature controls and other instruments. Automatic thermostatic by-pass takes care of air and gases without steam waste. All pressures up to 200 psi. Bulletin No. 450.



#### BUCKET

Intermittent, but very rapid—can handle large volumes of condensate. Air goes out with the condensate All parts attached to cover provide easy inspection. Straight-through connection makes installation easy. Integral strainer inside. Standard sizes to 250 psi. Forged steel types to 900 psi, and superheat. Bulletin No. 350.



#### LIQUID EXPANSION

A low cost combination of trapping and approximate temperature control. Ideal for outdoor tanks and lines and other points where condensate cannot be returned. In other forms, used as combination trap and control for wash tanks, food equipment, etc. Catalog Nos. 250 and 550.



| Process Tanks, small           | A   | C   |
|--------------------------------|---|---|
| Process Tanks, large           | В   | C   |
| Dryers, Coil Type              | В   | A   |
| Dryers, Fan Type               | В   | C   |
| Drying Tumblers                | В   | A   |
| Water Heaters                  | В   | C   |
| Preheaters, Fuel Oil           | В   | C   |
| Rotating Cylinders             | В   | В   |
| Slashers                       | В   | В   |
| Dry Cans                       | В   | В   |
| Flat Work Ironers              | C   | В   |
| Presses, Laundry               | C   | Α   |
| Stocking Forms                 | C   | Α   |
| Presses, Plastics              | С   | Α   |
| Presses, Platen                | С   | A   |
| Evaporators                    | В   | С   |
| Steam Lines Outdoors,<br>small | A   | D   |
|                                | Process Tanks, large Dryers, Coil Type Dryers, Fan Type Drying Tumblers Water Heaters Preheaters, Fuel Oil Rotating Cylinders Slashers Dry Cans Flat Work Ironers Presses, Laundry Stocking Forms Presses, Plastics Presses, Platen Evaporators Steam Lines Outdoors, | Process Tanks, large B Dryers, Coil Type B Dryers, Fan Type B Drying Tumblers B Water Heaters B Preheaters, Fuel Oil B Rotating Cylinders B Slashers B Dry Cans B Flat Work Ironers C Presses, Laundry C Stocking Forms C Presses, Plastics C Presses, Platen C Evaporators B Steam Lines Outdoors, |

Ask for Bulletin No. 1600 "Selecting Steam Traps"

26

CHOICE

CHOICE

SARCO

SARCO COMPANY, INC.

Represented in Principal Cities
Empire State Building, New York 1, N. Y.
SARCO CANADA, LTD., TORONTO 5, ONTARIO

# There's a Century MOTOR To Supply Dependable Power For All Popular Applications

Contary motors are evaluable in sizes from 1/6 to 400 horsepower, in a unite range of types and blinds — simple phase and polyphase alternating current, and direct current. All of them are regardly built to essure top performance throughout a long service life.

#### POLYPHASE

Type SC—OPEN PROTECTED
—Form J, general purpose motor—
meets the needs for most installations where operating conditions
are relatively clean and dry. The
top half of the motor frame is
closed to keep out falling solids or
dripping liquid.

Type SC—SPLASH PROOFgives the necessary protection where plants must be washed down—keeps water out of the motor even when a hose is applied directly on the frame. Also provides protection against rain, snow, sleet and use for outdoor installations.

Type SC-TOTALLY EN-CLOSED FAN COOLED protects against dusts, mist or fog detrimental to the vital parts of the motor. The inner frame protecting the motor is sealed to keep out harmful matter.

Type SC—EXPLOSION PROOF protects against atmospheres charged with explosive dusts or gases. They carry Underwriters' label for specific kinds of hazards.

Type SR—SLIP RING—wound totar motors are suitable for applications requiring low starting current with high starting torque, reversing, or adjustable speed.

Type SY—SYNCHRONOUS MOTORS—suitable for continucus operation at a uniform load for power factor correction.

#### SINGLE PHASE

Type RS—REPULSION START INDUCTION—single phase brush lifting motor suitable for applications requiring high starting torque with low starting current.

Type CSH—CAPACITOR START INDUCTION—single phase motor suitable when high starting torque with normal starting current is required.

Type SP—SPLIT PHASE, IN-DUCTION—single phase motors —suitable for light starting duty.

#### DIRECT CURRENT

Type DN—DIRECT CURRENT MOTORS—suitable for use where direct current is available or its use desirable.

These illustrations are typical of Century's complete line of motors. Others available include gear motors, generators, AC and DC motor generator sets.

Specify the right Century motor for all your electric power requirements.

Popular types of standard ratings are generally available from factory and branch office stocks.

#### CENTURY ELECTRIC COMPANY

1806 Pine Street St. Louis 3, Missouri













Officer and Dark Paints in Sciental Cities











## CHASE BAGS

BENEFITS
IN TERMS OF
YOUR BUSINESS . . .

Check every one of these important features of Chase Bags. They're important to you because they represent our efforts to assure good will ... and increase your sales.

Today, more than ever before, management is demanding better display of its premium products . . . and better protection of its premium products.

That's why you, too, should check today on Chase Bags—the containers which have been carrying American products for more than 100 years.

> Your Chase Salesman is a Packaging Expert who will be glad to help provide a more economical and more efficient container for your product. Don't delay—write us today on this important subject.

PROTECT YOUR PRODUCTS

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FOR YOUR PRODUCTS

. ATTRACTIVE PRINTING

.. DISTINCTIVE APPEARANCE
FOR YOUR PRODUCTS

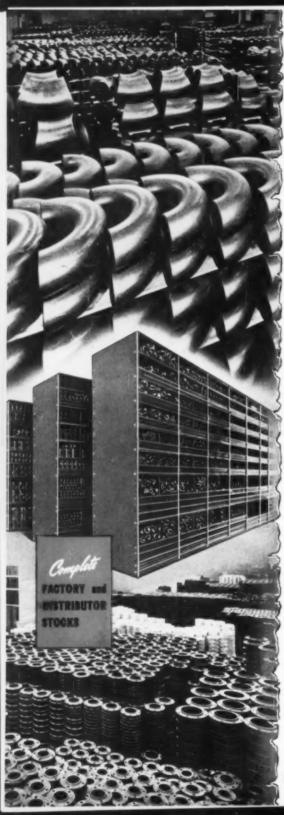
.. MORE SALES APPEAL FOR YOUR PRODUCTS

.. FOR BETTER ACCEPTANCE
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every piping system deserves the protection

SEAMLESS WELDING FITTINGS-1/2 INCH THRU 30 INCHES



FORGED STEEL FLANGES-1/2 INCH THRU 30 INCHES-LARGE O.D. THRU 96 INCHES



FORGED STEEL FITTINGS-SCREWED AND SOCKET WELDING-1/8 INCH THRU 4 INCHES



Means savings in time and dollars...for LADISH offers you a complete line backed with adequate stocks

Available in Carson ALLOY STAINLESS STEELS ALUMINUM COPPER & OTHER MON-FERROUS METALS

Whatever your fitting requirements...you can rely on the Ladish line for an unrestricted selection of Seamless Welding Fittings, Forged Steel Flanges and Forged Steel Fittings.

This Controlled Quality line is complete in types, size ranges and materials you need for virtually any application. Ladish also gives you such outstanding engineering developments to improve piping efficiency, as Seamless Reducing Elbows and Full Branch Taper Design Tees.

Adequate stocks in strategically located distributor warehouses...supplemented by extensive factory inventories of every type... give you double assurance of prompt service on every Ladish order. And, by standardizing on Ladish you know that every fitting is made to the unsurpassed standards of Controlled Quality for complete dependability.

A COMPLETE LINE PRODUCED UNDER ONE ROOF
... ONE RESPONSIBILITY

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of Controlled Quality fittings

You tell us! What uses can be made

of a process agent as clean as ...

### Swift's Animal Protein Colloid?



in a wide range of manufacturing processes. In fact, this product is so different from other colloids of its kind, many of its possibilities are unexplored. A few of its known uses are:

- 1. An emulsifier
- 2. A flotation agent
- 3. A gel structure
- 4. A settling agent
- 5. A protective coating
- 6. A sizing agent
- 7. A carrier of pigments
- 8. An impregnating agent
- 9. A base for pigments
- 10. An oilproofing agent
- 11. A flocculating agent
- 12. A clarifying agent
- 13. A filtering agent
- 14. A stiffening agent
- 15. A mordant
- 16. An adhesive
- ... but there may be many others of equal value!



Here a filter test indicates the relative cleanliness of this new process agent. Left: Ordinary commercial grade bone glue. Right: Swift's Animal Pro-

Try it for yourself. We invite you to test the possibilities of Swift's Animal Protein Colloid. It may meet your present requirements or help you to develop new products or more efficient processes.

For further information about Swift's Animal Protein Colloid write: -

#### What is this modern process agent?

Swift's Animal Protein Colloid is made by an exclusive Swift process. This process makes pos-sible the production of high quality protein colloid of unusual uniformity in particle size and composition.

In a spotless modern plant, protein liquor falls on a bed of dry finished product (see photograph) which adheres evenly to the droplets. By continuous schedule, under precise control every second, these droplets are dried, milled and

During this almost automatic operation, the product has no contact with materials which could contaminate it with foreign substances

As a result, Swift's Animal Protein Colloid is a clean, finely ground powder (light amber in color) which goes into solution rapidly.

### Swift & Company

Adhesive Products Department

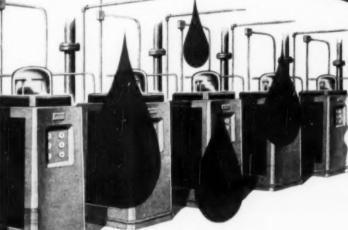
4105 Packers Avenue

Chicago 9, Illinois

### as you were in 1900

Effective methods of purifying water supplies were virtually unknown at the turn of the century





### as you afe today

Pure water and efficient sewage treatment are taken for granted in thousands of modern communities

### . because of pioneering by Niagara Alkali

In 1900 practically no community was protected effectively against nater-borne diseases. Today, every modern city and town is safeguarded by scientifically planned and operated water purification systems and sewage treatment plants.

Niagara Alkali Company, now approaching its 50th anniversary, helped to achieve this progress by pioneering the production and use in this country of liquid chlorine—for both water purification and sewage treatment. Niagara also helped improve paper, textiles, glass, soap and other products by pioneering the manufacture of caustic potash, carbonate of potash and caustic soda. Look to Niagara for pioneer quality and service in electro-chemicals.



60 East 42nd Street, New York 17, N. Y.

Liquid Chlorine - Caustic Potash - Carbonate of Potash - Paradichlorobenzene - Caustic Soda - NIALK TRICHLORethylene

Here's low-cost, mineral-free water

Do you want an inexpensive, high-quality substitute for distilled water? Permutit Demineralized Water may be used instead of distilled water for almost all purposes . . . at a fraction of the cost. It's today's big water bargain! ¶In this process, Zeo-Karb H,® Permutit's acid-regenerated organic cation exchanger, replaces metallic cations in the water with hydrogen ions. The salts present are thus converted into corresponding acids, which are then removed by De-Acidite,® a resin-type anion exchanger. ¶ It's advantageous to replace distilled water with Permutit Demineralized Water. For full information, write to The Permutit Company, Dept. CE-10, 330 West 42nd St., New York 18, N. Y., or to The Permutit Co. of Canada, Ltd., Montreal.

### Permutit® Demineralizing Process!

| Distilled Water Plant                  | A      |         | C       |        |
|--|--------|---------|---------|--------|
| Hardness as ppm CaCO <sub>t</sub>      | 0      | 10      | . 0     | 11     |
| Alkalinity as ppm CaCOs                | 13     | 18      | 4       | 31     |
| Sulfates as ppm 50;                    | 0      | 0       | . 3     |        |
| Chlorides as ppm CL                    | 4      | 0       | 1       | 1      |
| Total Saits as ppm CaCO <sub>3</sub>   | 19     | 18      | 9       | 21     |
| Dominoralized Water Plant              | A      |         | C       |        |
| Hardness as ppm CaCO <sub>1</sub>      | 0      | 0       |         | 1      |
| Alkalinity as ppm CaCO,                | 3      | 4       | 2       | 4      |
| Sulfates as ppm SO <sub>2</sub>        | 0      | 0       | 0       | 1      |
| Chlorides as ppm CL                    |        | 0       | 0       | 0      |
| Total Salts as ppm CaCO <sub>3</sub>   | 3      | 4       | 2       | 5      |
| REGENERANT COSTS & RAW WATER ANALYSES: | 4 IND. | DEMINER | ALIZING | PLANTS |
| Plant                                  | A      |         | C       | D      |
| Hardness as ppm CaCO <sub>2</sub>      | 43     | 116     | 212     | 261    |
| Alkelinity as ppm CaCO <sub>2</sub>    | 34     | 58      | 140     | 188    |
| Sulfates as ppm 50 <sub>1</sub>        | 19     | 70      | 80      | 60     |
| Chlorides as ppm CL                    | 4      | 2       | 24      | 10     |
| Total Salts as ppm CaCOs               | 64     | 149     | 274     | 277    |
| Regenerant Costs per 1000 gals.        | 5.03   | \$0.08  | \$6.15  | 50.12  |



Permutit

WATER CONDITIONING ION EXCHANGERS MATERIALS AND EQUIPMENT

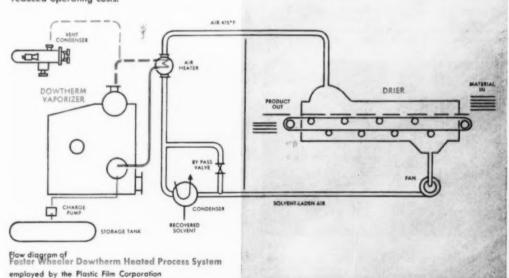
#### UNIFORMITY

#### both in the means and in the end result

Making plastic film requires precision control of all operations from chemical synthesis to heating and drying.

FOSTER WHEELER indirect heating equipment plays an important part in a special process developed by the Plastic Film Corporation. Indirect heating with Dowtherm makes it possible to expose film to air at a high temperature (475 F) for drying or other conditioning without risk of fire or spoilage.

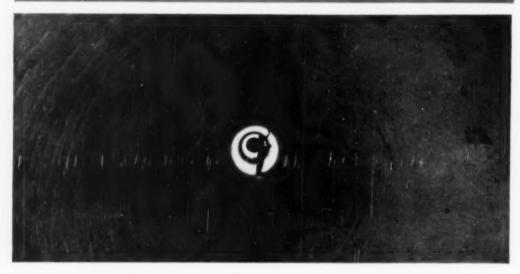
Process heating systems with Dowtherm vaporizers—designed, engineered, and built by Foster Wheeler—provide the uniform and precisely controlled temperatures which contribute to improved production quality and reduced operating costs. PLASTIC FILM



FOSTER WHEELER CORPORATION 165 Broadway, New York 6, New York

CHEMICAL ENGINEERING -October 1949

# Life ... on the



CALCINATION OF UNITANE® TITANIUM DIOXIDE takes place inside this giant rotary kiln located at the Gloucester plant of Cyanamid's Calco Chemical Division. One of the country's major producers of this important pigment. Calco supplies its high quality Unitane

brand in several grades of both the anatase and rutile types to meet industry's most exacting requirements. Use the coupon to send for free folder giving specifications and properties on all grades of Calco UNITANE.



PLASTIC DISHES made of Melinac® Molding Compound go on sale this month to Mr. and Mrs. Public via department stores all over the country. To be introduced by advertising in national magazines, this new day dinnerware will be offered in many attractive colors. Cyanamid's Melinac Molding material is also widely used for many industrial and electrical applications. Further information on its properties and applications will be sent promptly on request. Just check the coupon.



As the "FIX-UP, PAINT-UP" BRIGADE goes to work this fall, brighter tints will be increasingly popular for interior decoration. For the paint trade, Ultramarine Blue, manufactured by Cyanamid's Calco Chemical Division, is one of the most brilliant tinting materials available. This blue pigment finds application in the preparation of paints, papers, inks, floor coverings and a wide range of other products. A technical bulletin on the properties and application of Calco Ultramarine is available on request.

### Chemical Newsfront



PEPTON® 22, RUBBER PLASTICIZER reduces breakdown time by more than 50% and has the added advantage that it may be added directly to the latex solution prior to coagulation. This makes it possible to eliminate this operation in the compounding room-another important advantage. Photo above shows treated No. 1 Ribbed Smoked Sheets being examined as shipment arrived at a U.S. port. Further information on Peprox 22 will be supplied on request. Just check the coupon below.



SAMPLE PACKAGES DRESS UP. Cyanamid's new sample bottles are graduated, in both fluid ounce and cc, scales, permanently fused in the glass, to enable users to approximate at a glance the amount of the contents. They also provide handy laboratory re-use containers. Two styles, narrow mouth for liquids and wide mouth for solids, are available in 4- and 8-ox. sizes equipped with screw caps made of Cyanamid's Bertle® Plastic. This is another Cyanamid development in chemical packaging for convenience of its customers,



NATIONAL METAL EXPOSITION will be held in the Cleveland Public Auditorium, Cleveland, Ohio, October 21s to 27th. Cyanamid, exhibiting at the show, will have on display its Aerocarre Carburzing Compounds and other products for the metal treating industries. Featured will be Aerocarre E & W, offering an improved "easy-washing" method that cuts washing time from hours to minutes, plus several other advantages. Advance technical information will be mailed on request.

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|     | American Cyanamid Company<br>Industrial Chemicals Design                |     |
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|     | 30 Rockefeller Plaza, New York 20, N. Y.                                |     |
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|     | Unitane Titanium Dioxides for   |     |
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|     | ☐ Melmac Molding Compound   |     |
|     | MAC Molding C   |     |
|     | Calco Ultramarine   |     |
|     | CLIRAM ARIVE  |     |
|     | PEPTON 22 Plasticizer   |     |
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AMERICAN Gyanamid COMPANY

# **CROUSE-HINDS** prevent harmful water condensation

#### under humid conditions

- FORESTALL the formation of destructive mildew by ventilating enclosures.
- EXTEND the LIFE of insulation and equipment under adverse conditions.
- MINIMIZE the danger of expensive shut-downs due to insulation or equipment failure.

Paragraph 5015-C5 of the 1947 National Electrical Code states that "where there is a possibility that water or other condensed vapor may be trapped at any point in the raceway system, approved means shall be provided to prevent accumulation, or to permit periodic draining of such water or condensed vapor

Explosion-proof electrical enclosures cannot be vented in any of the usual ways because they must be kept flame-tight. Crouse-Hinds' explosion-proof Type ECD Breathers. Type ECD Drains, and Type EZD Drain Sealing Condulets meet the Code requirements and are listed by Underwriters Laboratories for such service.

The Breathers are similar to the Drains but have metal hoods which make them water and dust shedding. Both have corrosion-resisting bodies with internal flame-tight (but not airtight or watertight) laby-They can be used freely without impairing the explosion-proof integrity of a conduit system, providing they are always installed in a Condulet hub or other opening with five or more full threads engaged.

In humid atmospheres, water condensation occurs in explosionproof systems, especially where temperature changes are frequent. Accumulation of water in harmful quantities is common. bacterial growth, is often present. It attacks many insulations and will destroy them unless the cause is removed. In such humid atmospheres troubles of this nature can be avoided by the proper installation of Crouse-Hinds' Breathers and Drains in conjunction with explosionproof Condulets

Breathers should be placed at the highest points and Drains at the lowest points of all housings and conduit runs. Heat generated by the current flowing through conductors and electrical devices raises the temperature of air within the conduit and housings. Breathers and Drains permit the resultant upward passage of the warmed air to re-move moisture and thoroughly ventilate the enclosures. This prevents the accumulation of water and removes moisture that may have collected under unusual conditions.

This method is successfully used in many of the largest plants in the chemical and petroleum industries. Several years of field experience has demonstrated that the moisture is either entirely removed by ventilation, or so reduced that it is not harmful.

These devices have also been successfully used in non-hazardous locations where condensation is troublesome.

If you have a condensation problem. Crouse-Hinds Company will addy assist in solving it. Write to gladly assist in solving it.

#### CROUSE-HINDS COMPANY Syracuse 1, N. Y.

CONDULETS are made only by CROUSE-HINDS

BREATHE

Type ECD Drain Type ECD

CONDULETS with Crouse-Hinds Breathers and Drains can be in-stalled for ventilation throughout an entire explosion-proof conduit system

Breather



Type EZD Explosion-Proof **Drain Sealing Condulet** 

Nationwide Distribution Through Electrical Wholesalers

ECD Breather

GUAT

ECD

Drain

AIRPORT LIGHTING · FLOODLIGHTS

# For More Efficient Filtering ...Mt. Vernon Extra



Bronch Offices: CHICAGO . ATLANTA . BALTIMORE . BOSTON . LOS ANGELES . AKRON
CHEMICAL ENGINEERING—October 1949



### Vertical-Unit Boiler that assure

#### low-cost steam for medium and smaller plants

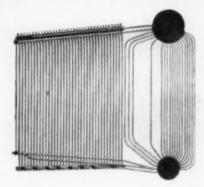
The structural features i'llustrated and described on these pages are to a large degree responsible for the efficient combustion, consistent production of dry steam at all ratings, high thermal efficiency, trouble-free operation and low steam costs which characterize the operation of the many hundreds of Vertical-Unit Boilers, Type VU-50, in service throughout the United States and in many foreign countries.

Designed to meet exacting, big-plant specifications, the VU-50 Boiler brings to medium-sized and smaller plants the advantages of Combustion's experience with high capacity, high pressure units, plus the obvious benefits of standardization. The VU-50 is virtually universal in application. It is available in capacities up to 350,000 lb of steam per hr. It can be adapted to meet widely varying conditions of load, pressure and temperature. It can be fired with coal, oil, gas or any combination of these fuels. Compare its features item by item with those of any similar equipment on the market. They explain why C-E Vertical-Unit Boilers are so widely regarded as the finest equipment available for any steam requirements to which they are applicable.

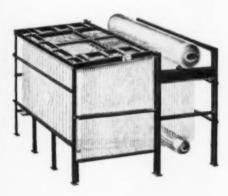
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ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS, ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS



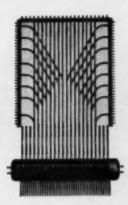
Symmetrical Design. Any section taken through the unit from the front to rear is similar to any other section so taken. Each elemental section includes the same amount of furnace volume, the same amount of boiler heating surface and the same amount of superheater surface as any other. The volume of gases, their velocity and temperature, at any point from front to rear, are practically constant across the width of the unit.



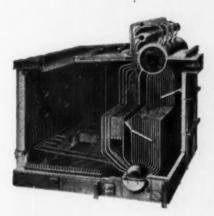
Overhead Suspension. Complete freedom of expansion in all directions is provided by suspension of all parts of the unit from the steel structure which provides the framework for the outer steel casing. This feature makes ample provision for the effects of temperature changes; it eliminates abnormal mechanical stresses on all pressure parts and explains to a large degree the freedom of the VU Unit from leaky joints.



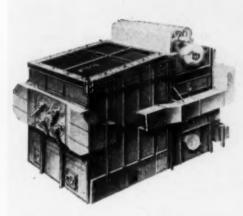
Quality Steam. All of the most active steam producing tubes enter a baffled area in the drum which discharges well above the normal water line and uniformly across the full length of the drum. This arrangement reduces turbulence to a minimum and permits effective utilization of the entire steam release space. Dry steam and a stabilized water level are thus assured even under adverse conditions.



Standardized Construction. Painstaking refinement of detail is incorporated in each unit at a small fraction of the original engineering cost. With standard parts and structural features the merits of which are confirmed by experience, manufacturing and erection costs are materially reduced. First cost reflects the economies of standardization and the buyer benefits even before the VU Unit is placed in operation.



Adaptable In Application. The VU Unit can be adapted, without sacrifice of the benefits of standardization, to a great variety of conditions: where space limitations are imposed; to burn coal, oil, gas or any combination of these fuels; to meet widely varying requirements of load, pressure and temperature. Inclusion of inter-bank or inter-tube superheater or an air heater is easily accomplished as conditions require.



Steel Encased Setting. The unit setting of shaped tile, refractory and 100% insulation are attractively finished by a permanent outer steel casing. This design, evolved from careful study and experiment, reduces to a minimum heat losses caused by radiation and air infiltration. It tends to eliminate hot spots and helps maintain a uniformly low surface temperature throughout the steel casing. Maintenance is negligible.



SERVING INDUSTRY, AGRICULTURE AND PUBLIC HEALTH

Mathieson's BALTIMORE bound...

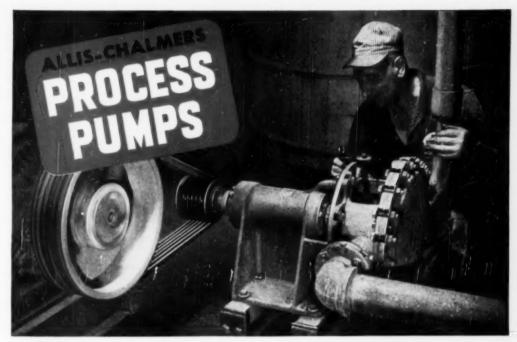
· This fall, Mathieson Chemical Corporation moves to its new executive offices in the 34-story Mathieson Building, Baltimore, Maryland.

In this new location, deep in the chemical heartland of America, we will continue to serve our customers quickly and efficiently.

Mathieson Chemical Corporation MATHIESON BUILDING BALTIMORE 3, MARYLAND



October 1949—CHEMICAL ENGINEERING



## ves \$1, PUMPING ABRASIVE

A-2736

#### No repairs in 2 years Head and capacity maintained

A LARGE MIDWESTERN PROCESSOR used conventional pumps to handle acidulous liquor with highly abrasive carbon. Maintenance was high; breakdowns frequent. When A-C process pump took this tough job, maintenance dropped over \$1,000.00 a year.

#### **HOW THIS SAVING IS POSSIBLE**

A-C process pumps give you added life and much lower maintenance costs because (1) the unique hydraulic design greatly reduces stresses on rotating parts, (2)

and Vari-Pitch are Allis-Chalmers trademarks.

wearing parts are separated for easy, economical replacement, and (3) you have a choice of 4 stock materials which are alloyed for resistance to different combinations of abrasion and corrosion. Other notable features include stuffing box on suction side . . . closed impeller . . . extra thick sections . . . adjustable clearance between impeller and wearing plate.

Shipment from stock on complete pumps and all parts in aluminum-bronze, Niresist, 18% chrome steel and 316 stainless steel. See your A-C Dealer or Sales Office or write for bulletin 08B6615.

ALLIS-CHALMERS, 1147A SO. 70 ST.

MILWAUKEE, WIS.

Sold . . .

*LIQUOR!* 

#### Applied . . . Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Sheps and Sales Offices



MOTORS - 1/2 to 25,000 ha end

CONTROL - Menual, magnetic and combinetion starters; push but-ton stations and components for complete con-





CHEMICAL ENGINEERING—October 1949

### PREFERRED

### SOLVAY Products for the Soap Industry

CAUSTIC POTASH

CAUSTIC SODA

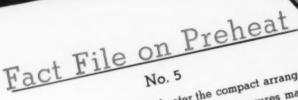
SODA ASH

POTASSIUM CARBONATE

CALCIUM CHLORIDE

SOLVAY SALES DIVISION

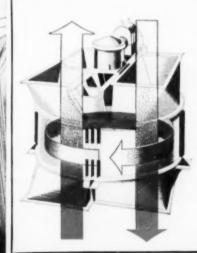
ALLIED CHEMICAL & DYE CORPORATION
40 Bacter Street, New York 6, R. Y.



In the Ljungstrom air preheater the compact arrangement of rotating heat transfer elements assures maximum heat recovery for its size and weight.

The higher recovery possible with the regenerative feature more than compensates for the small amounts of air that pass to the gas side of the heater by entrainment in the moving rotor and at the seals. This passage of air is predictable and consistent during the life of the plant with allowance being readily made in the initial selection of the preheater and fans.

LJUNGSTROM



The Ljungstrom Air Preheater is a compact gasto-air or gas-to-gas heat exchanger, operating on a continuous regenerative counterflow basis. Hundreds of leading power plants and other special applications confirm its high level of heat recovery and long-term low maintenance service.

#### THE

#### AIR PREHEATER CORPORATION

60 EAST 42ND STREET . NEW YORK 17, N. Y. Plant: Wellsville, N. Y.

# EXIDE-IRONCLAD BATTERIES ARE DIFFERENT!

They are specially designed to provide years of dependable service in all MOTIVE POWER WORK

Storage batteries are called upon to perform many tasks. No single type of battery is adequately suited to all. To meet these numerous requirements. Exide engineers have developed special types, to fit each application. Among these several types is the specially designed Exide-Ironclad Battery. Details shown below.

VENT PLUG specially designed to prevent excape of electrolyte.

GREASE SEAL RING NUT holds bettery elements securely in place ... prevents treedage of elettrolyte keeps tops clean and dry.

SEPARATOR of high parasily, specially treated to last the life of

NEGATIVE PLATE made entra heavy and built to match the long life of the positive plate.

JAR made of specially tough and durable Giant Compound, Built to withstand the jolts and jars of hard industrial usage.

PRET, internal shart circuits practically eliminated because the five feet on negative plate rest on different ribs from those of the positive plate, and because sepgrators extend below both plates and rest on all four ribs.

RIBS support all plates end separators. Their height provides genereus sediment space so that internal cleaning is unnecessory.

### DIFFERENT IN DESIGN DIFFERENT IN CONSTRUCTION DIFFERENT IN SERVICE QUALITIES

Chief among these differences is the unique positive plate, an exclusive Exide feature.

# U

#### EXIDE-IRONCLAD POSITIVE PLATE

Consists of a series of finely-slotted tubes which contain the active material. So small are these slots that, while permitting easy access of electrolyte, they retard the active material from readily washing out or jarring loose . . . adding considerably to life of plate.

Exide-Ironclad Batteries have ALL FOUR of the characteristics that a storage battery must have to assure maximum performance from battery electric industrial trucks—high power ability, high electrical efficiency, ruggedness and a long life with minimum maintenance. The combination of these four Exide-Ironclad characteristics assures years of dependable day-in, day-out service.



#### DESIGNED FOR STATIONARY USE

The Exide-Manchex Battery has the manchester type positive plate with the lead button construction. Specially designed for stationary use in many classes of industry.



The Exide Automobile Battery has plates of staggered grid construction. Specially designed for use in automobiles, trucks, buses, aircraft and numerous other applications.



#### DEPENDABLE



1888...DEPENDABLE BATTERIES FOR 61 YEARS...1949

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • Exide Batteries of Canada, Limited, Toronto

CELANESE\*
ACETIC

OVERNIGHT DELIVERY BY TANK TRUCK



#### to all points in Southern Textile Areas

A new, up-to-the-minute service for the textile industry is now in operation with the completion of terminal facilities at Rock Hill, South Carolina. From this storage point, textile plants in the southern area can obtain overnight deliveries of the highest quality acetic acid—in tank truck quantities.

This southeastern source for acetic acid will give Celanese customers the benefits of bulk prices and the efficiency of less-than-tank-car shipments.

#### GLACIAL ACETIC ACID U. S. P.

Also lower concentrations to 80%

#### CELANESE CORPORATION OF AMERICA

Chemical Division, Dept. 53-J 180 Madison Avenue, New York 16, N.Y.



\*Reg. U.S. Pat. Off.

ALCOHOLS - ALDEHYDES - GLYCOLS - KETONES - ACIDS - SOLVENTS - PLASTICIZERS - INTERMEDIATES

CHEMICAL ENGINEERING-October 1949

miracle is born

... an astounding now
principle of NORDSTROM
valve lubrication
valve lubrication

# SELF-SEALING SELF-THINKING CONTINUOUS PRESSURE SPLIT-SECOND ACTION

Greatest improvement in history of Nordstrom valves

gives effect of improved design without mechanical change



Tried, tested, proved in laboratory, field and plant

Keeps Nordstrom valves in state of perfect lubrication

### AN energizable LUBRICANT

#### to seal Nordstrom valves automatically and continuously

Fully automatic lubrication for Nordstrom valves is here! Introduction of Rockwell Hypermatic lubricant marks the greatest advancement in the valve industry since the invention of Nordstrom valves 30 years ago. Hypermatic is the first and only genuine automatic lubricant.

Now you can make deep cuts in your valve maintenance cost because your lubrication crew need devote only 1/10, 1/20, 1/50, up to 1/100 as much time to re-lubrication.

Your Nordstrom valves will give better service with less cost because each one will be automatically maintained in a condition of 100% lubrication, even in event of considerable neglect.

Leakage will be prevented because Hypermatic both seals and lubricates with split-second action and positive certainty.

Unlike any other lubricant, Hypermatic is compressible and expansible. Self-powered energy is created within the lubricant merely by turning the lubricant screw or using a grease gun. This energy then serves as a powerful force-feed. Almost twice as much Hypermatic can be compressed into the valve's lubricant chambers. The pressure is retained, not for days, but for months, if the valve is not operated. If frequently operated, Hypermatic will retain its pressure for scores of turns longer than if non-automatic lubricant is used.

#### NOTHING TO BUY EXCEPT THE LUBRICANT

Instead of resorting to the use of extraneous devices or endeavoring to use variable line pressure, Hypermatic provides a new system of lubrication which gives the effect of a vastly improved valve design. You don't have to invest a single cent in mechanical devices. You don't even have to purge the old lubricant. Simply switch to Hypermatic and apply it to your present Nordstrom valves. It will displace the old lubricant.

Your Nordstrom valves will use less Hypermatic than non-automatic lubricant because Hypermatic creates, by its flexible nature, a "spring-action" which to a great extent prevents over-lubrication and under-lubrication.

#### IT COMPRESSES

Like the action of a door-check, Hypermatic compresses to a fraction of its volume when the lubricant is forced in. This stores up energy for future use.



Then the value of

When the valve needs lubricant to seal a leak, its inherent energy forces it to expand and seal the valve seat. It feeds into any void instantly.

FOR NORDSTROM VALVES

# MAN-HOURS SAVED TWICE THE STORAGE MULTIPLIED VALVE LIFE GALLING ELIMINATED SAVES LUBRICANT

Switch to Hypermatic-stocks now available.

Place your order immediately for this new, amazing automatic lubricant. A variety of types is available to meet approximately 75 per cent of Nordstrom valve services. Field demonstrations are now being arranged.

#### NORDSTROM VALVE DIVISION - ROCKWELL MANUFACTURING CO.

400 North Lexington Avenue \* Pittsburgh 8, Pennsylvania
Atlante, Boston,
Chicago, Calumbus, Houston, Kansas City, Los Angeles, New York, Pittsburgh.
Son Frencisco, Scottle, Tulsa . . . and leading Supply Houses

Export: Rockwell Manufacturing Company, International Division, 7701 Empire State Building, New York 1, New York

### Mail this coupon for HYPERMATIC Bulletin

NORDSTROM VALVE DIVISION, Dept. 19
Rockwell Manufacturing Co.
400 North Lexington Ave., Pittsburgh 8, Pa.
Send Hypermatic Bulletin and Specifications

Name

Address

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Scare.

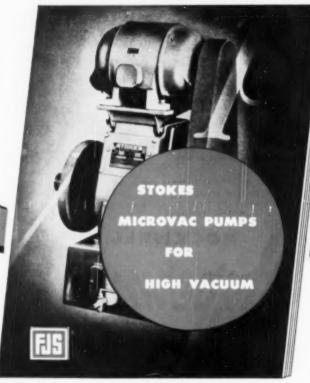
City

Company-

ASK STOKES

### VACUUM DATA For Chemical Processing

To men in the chemical processing industry . . . we offer this NEW data book on High Vacuum Pumps and related vacuum equipment.



The book provides, for the first time, significant information, practical vacuum problems, charts, curves and tables which are invaluable to the engineer, the works manager, the purchasing agent, and the research man. Your copy of this useful book will be sent on request. F. J. Stokes Machine Company, 5920 Tabor Road, Philadelphia 20, Pa.

Stekes makes Semi-Automatic and Automatic Molding Presses, Plunger Presses, Cosure Presses, Preforming Presses, Industrial Tabletting and Powder Metal Presses, Vacuum and Special Processing Equipment, Water Stills and Special Machinery.

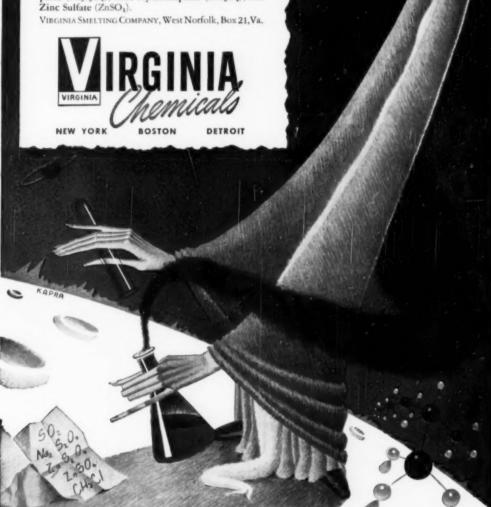
STOKES

KNOWS



Professional competence and experience—rather than the dark and devious ways of alchemy—are the contributions of "Virginia" chemists to the solution of your problems. It is likely that their know-how—applied to some perplexity of your products or processes—will spark an idea for great improvement. They have pioneered many timeand money-saving applications of basic "Virginia" industrial chemicals. They'd like to take the measure of your problem, now.

Write today for literature descriptive of the varied properties and uses of the basic "Virginia" chemicals — Liquid Sulfur Dioxide (SO<sub>2</sub>); Sodium Hydrosulphite (Na<sub>2</sub>S<sub>2</sub>O<sub>4</sub>); Zinc Hydrosulphite (ZnS<sub>2</sub>O<sub>4</sub>); and



### Why you should specify. . .

### HOOKER MURIATIC ACID



**IF YOU MANUFACTURE DYES**—because Hooker Muriatic Acid is free from sulfates, oxides of nitrogen and iron, impurities that cause precipitates or add unwanted colors to benzidene dye.



**IF YOU ARE REFINING HIGHGRADE ORES**—because Hooker Muriatic Acid is free from sulfates or sulfuric acid, that cause serious losses in extraction.



IF YOU ARE MAKING PHARMACEUTICALS OR FOOD STUFFS—because Hooker Muriatic Acid is free from sulfates, iron and arsenic, that cause insoluble precipitates, discoloration or contamination.



IF YOU ARE PICKLING OR CLEANING METALS — because Hooker Muriatic Acid is free from arsenic, that may react with liberated hydrogen to form Arsine (AsH<sub>3</sub>).



IF YOU MANUFACTURE CHEMICALS—because Hooker Muriatic Acid is of such high quality that you get better yields of better quality and without harmful side reactions.

Hooker Muriatic Acid is available in two grades—commercial (light yellow color) and Hooker White—(colorless) both free from arsenic. It is shipped in carboys or tank cars and in three strengths, 18°, 20° and 22° Baume. Hooker Technical Data Sheet No. 720 gives Hooker specifications, dilution instructions and other valuable information. Send for a copy on your company letterhead.

From the Salt of the Earth

HOOKER ELECTROCHEMICAL COMPANY

 Γ.

SODIUM SULFIDE . SODIUM SULFNYDRATE . SODIUM TETRASULFIDE . CAUSTIC SODA . MURIATIC ACID . PARADICHLOROBENZENE . CHLORINE



BY WATER AND RAIL, A.O. Smith ships pressure vessels for the petroleum, paper, and process industries. The SMITHlined Fractionating Tower above, one of the largest shopfabricated vessels ever built (16 ft. diameter by 116 ft. long, weighing over 320,000 lbs.), is going by barge to an oil refinery in the Chicago area.



SOME 60 SMITHWAY PRESSURE VESSELS for both low and high temperature service have been ordered during the last four years by one company to equip two new plants.

This SMITHway Tower, three railroad cars long, 116 ft. by 7 ft., weighing 137,000 lbs., is one of the types of vessels furnished.



THIS MAN KNOWS HIS CURVES: For 23 years, Frank Hilke has been shaping, to exact diameters, the shell courses of SMITHway Pressure Vessels. He uses a variety of rolls which can produce any diameter needed for pressure vessels.



RECORDING CONTACT RESISTANCE AS LOW AS 1/1,000,000 OHM. Intensive research into the surface resistance of various alloys of different finishes and thicknesses has played an important part in the development of the A. O. Smith process of resistance welding alloy linings to carbon steel backing. This SMITH-built instrument was designed to measure the various resistance properties of the alloy linings and is a valuable tool in the control of the quality of A. O. Smith resistance welding.

#### IN THE CHEMICAL PROCESS INDUSTRIES:

### 6 out of 10 Men Who Buy Gauges Specify US Gauge



### ... Because USG Assures ACCURACY - DEPENDABILITY - QUALITY

There's no room for guesswork in selecting gauges to measure and control chemical, food and other processes. The preference shown for US Gauges by the majority of instrumentation men and chemical engineers is a reliable indication that US instruments give them more value . . . accuracy, dependability, quality.

They know that USG can supply gauges for all of their requirements however exacting . . . from highly specialized instruments measuring less than 1" of mercury absolute to standard type gauges measuring from 30" vacuum to 100,000 pounds pressure per square inch.

US Gauge's research and design engineers have pioneered the development of many new and improved gauges especially for application in the process industries. Get more information about these instruments now. Write today. Ask for a copy of the new USC catalog. No obligation. United States Gauge, Division of American Machine and Metals, Inc., Sellersville, Penna.

US GAUGES—BETTER INSIDE...BETTER
OUTSIDE...BETTER ON YOUR PRODUCT





#### ABSOLUTE PRESSURE GAUGE

A highly occurate, dependable instrument for measuring absolute pressures. Gauge is seal case type designed to indicate pressure or vacuum admired to indiserve or vacuum admired to indiserve is corrosson resistent, suitable for sea in highly conformation admired for sea in highly conformation and office or seal in the season of the season of



#### HIGH PRESSURE SOLID

Designed for testing high pressure gases and liquids these gauges are built to the highest possible standard. Said wall, cast inkegal with case, separates the tube and movement section from observer. Bourdon subset of specially selected berythim copper or stainless steel are threaded at both ends. Host deep bushed standards streel may be a second of high cotion. Cast brass case and ring. Bonger. 100 to 100,000 lbs. pressure.



#### SUPERGAUGE FIG. 1610

For heavy duty service where a gauge of exceptional quality and accuracy is required. Bourdon habe and heavy duty bushed movement of stainless sheet to withstand corrosive atmosphere and pressure media. Available in cost ion e phonolic cases in ranges 0 to 30% vacuum to 20,000 P.S.I. Furnished in combination with a wide variety of gracious metal diaphragm ethackments.



PRODUCTS OF UNITED STATES GAUGE... Absolute Pressure Gauges • Aircreft Instruments • Air Volume Controls • Altitude Gauges • Boiler Gauges • Chemical Gauges • Dial Thermometers • Gloss Tube Thermometers • Flow Meters • Inspection' Test Gauges • Leboratory Standard Test Gauges • Marrine, Ship and Air-Brake Gauges • Recorders • Controls and Alarm Gauges • Voltmeters • Welding Gauges

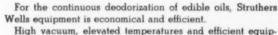


C. Top of column

D. Steam jet vac equipment



Continuous Deodorizers for Edible Oils



high vacuum, elevated temperatures and efficient equipment design gives low steam consumption. Liberal heat exchange equipment reduces the heating load, and the use of automatic controls largely eliminates operating attention.

The Struthers Wells Dowtherm heating system used is efficient and trouble free; steam may be directly superheated in furnace, thus reducing equipment costs.

A semi-plant scale continuous deodorizer as set up in our laboratory and shown in accompanying views, permits production of commercial quantities of oils under conditions closely approximating full scale operation.

On the basis of such tests, large scale equipment for the deodorization of special synthetic heat sensitive fats and other special oils has been constructed.

Struthers Wells also supplies complete batch deodorizers, or semi-continuous types.

#### STRUTHERS WELLS CORPORATION

Process Equipment Dept. WARREN, PA.

Plants at Warren and Titusville, Pa.





A. Base of columns

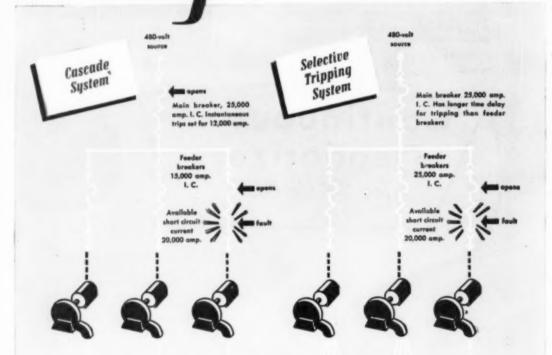
A Dowthern boiler is used for heating.



Continuous doodorizer, as installed in Struthers Walls laboratory, the views above showing equipment at various floor elevations.

# What's the trend in chemical plant electrification?

## ... better



Cascade system is used where service continuity is not a "must." Here the main air circuit breaker is used to assist the feeder breaker to interrupt all faults over 80 per cent of feeder breaker's capacity. Lesser fault currents are interrupted by the feeder breaker alone.

Selective tripping system lets feeder air circuit breakers interrupt all fault currents on feeders. Main air circuit breaker opens only for bus faults or because of failure of feeder breaker. Thus, a short circuit in one feeder does not interrupt power to other feeders.

Here's what you need to modernize your power system!

WHEN YOU COME TO GENERAL ELECTRIC you get far more than the finest in electrical equipment. A General Electric application engineer, familiar with chemical plant practice, is at your disposal. If desired, he stands ready to take over the job of co-ordinating all the needed components, engineering your power distribution into one modern, efficient system.

# protection against shutdowns

#### WITH SELECTIVE TRIPPING

### — to isolate faults on low-voltage circuits

Although comparatively new, selective tripping of air circuit breakers is becoming increasingly important in the field of low-voltage power distribution. Especially is this the case in applications—such as continuous processing in chemical plants—that require a high degree of service continuity. By isolating faults at remote points without tripping the main supply breaker, this method eliminates the costly production delays caused by complete power shutdowns.

With selective tripping, full interruptingrating breakers are used throughout, with differently-timed tripping ranges arranged so that the breaker farthest from the power source trips first. Thus, only that portion of the circuit nearest the fault is isolated. The rest of the power system stays in operation, permits uninterrupted production elsewhere in the plant.

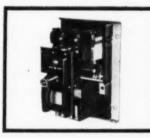
For complete information on this new and cost-saving way of protecting your important low-voltage circuits, write for Bulletin GET-1485 "Selective Operation with Air Circuit Breakers." Apparatus Dept., General Electric Company, Schenectady 5, N. Y.



FREE G-E AIDS TO POWER SYSTEM SAVINGS! Here are ideas you can use on how to cut the cost of power distribution—your plant's most critical "materials handling" problem. Offered by General Electric as a service to your industry, they're contained in a full-color sound slidefilm, a factual manual, and a supplementary review booklet. All this is available to you and your organization without charge. Just ask your G-E representative to arrange for a showing of the film "Modern Industrial Power Distribution."



G-E metal-enclosed switchgeer, containing oir circuit breakers with new trip device, needs less floor space. Features include new rackout mechanism, improved bus construction.



In the G-E Type AK-1 eir circuit breaker (shown here with one trip device removed) you get improved erc interruption, multiple arcing contacts, and interchangeable trip units.



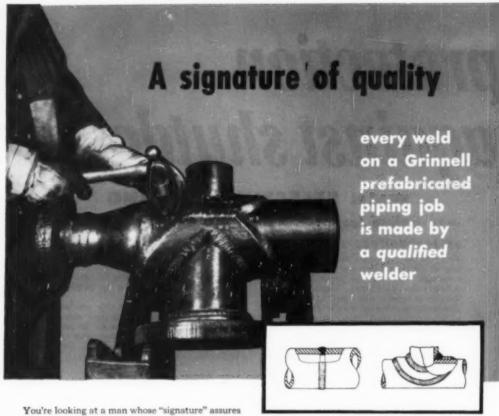
New G-E Type EC-1 tripping device for AK-1 air circuit breakers is sealed to eliminate maintenance, easily adjusted, readily removable for changing trip characteristics.

GENERAL



ELECTRIC

962-2



You're looking at a man whose "signature" assures quality welding of piping. He's a Grinnell welder and, as every Grinnell welder, he is qualified by Grinnell according to a procedure which conforms to A.S.M.E. Boiler Construction Code, Section 9. After qualifying, he is given a number which he "signs" adjacent to each weld he makes.

Quality welding is only one of a long chain of responsibilities assumed by Grinnell on every prefabricated piping job . . . from the interpretive engineering to the on-time delivery of the fabricated piping. Such responsibility requires facilities for metallurgical research and testing, comprehensive knowledge of state laws and industry codes, and a complete familiarity with insurance company requirements for fabricated piping.

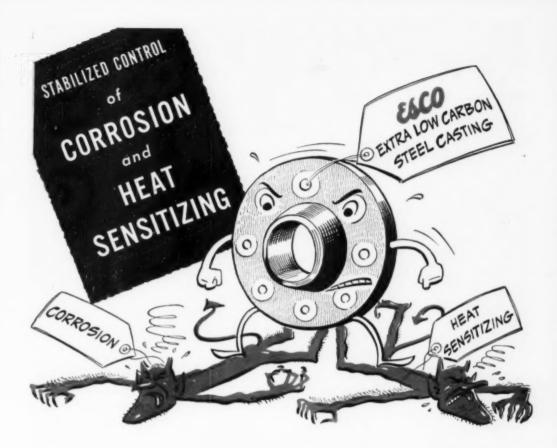
The fabrication of piping for today's high pressure, high temperature or corrosive services is a job for experts. It's a job for Grinnell prefabricating plants because Grinnell has the modern equipment and methods, and the skilled personnel which enable them to assume total responsibility for the job.



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You can weld your stainless castings without subsequent heat treatment, yet retain initial effectiveness against corrosion... Your castings will handle materials heated to elevated temperatures without becoming sensitized...IF your castings are made of ESCO Extra Low carbon stainless steel.

With a maximum carbon content of .03%, these castings suffer a minimum of carbide precipitation when welded or heated. Initial resistance to corrosion and heat remains constant.

Perhaps an ESCO extra low carbon stainless steel casting will solve a problem in your plant. You are invited, without obligation on your part, to write us about it. Completely staffed engineering and metallurgical departments are available to help find a practical solution.

Literature available upon request.

Electric Steel Foundry, 2143 N.W. 25th Avenue, Portland 10, Oregon. Offices in Eugene, Oregon; Chicago; Honolulu; Houston; Los Angeles; New York City; San Francisco; Seattle and Spokane. In Canada, ESCO Limited, Vancouver, B.C.



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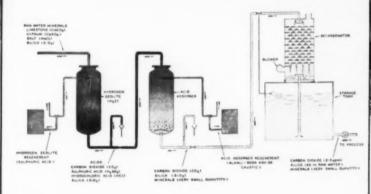
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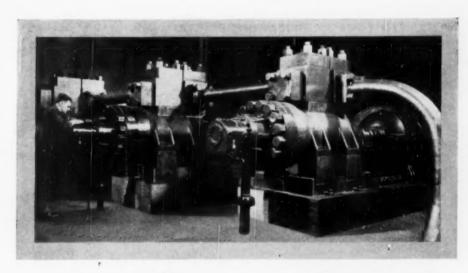
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### for the World's Largest Industrial Centrifugal Pumps

#### to insure top performance, long life

Largest pump capacity in terms of pressure and volume of any industrial centrifugal pump installation in the world is found in the hydraulic system of the 18,000-ton forging press at Wyman-Gordon Products Corporation. Capacity is 1500 gal. per min. at 5300 lbs. per sq. in. — enough energy to pump the water contained in twelve tank cars in one hour from sea level to the top of Mount Whitney (altitude 14,510 ft.)

This unusual installation consists of three 8-stage units connected in series. Pressure increase through each pump is 1750 lbs. per sq. in. Each is driven by a 1,000 hp motor, and has an individual lubricating system which supplies Gulf Harmony Oil, noted for its successful performance under heavy loads, to the pump and motor bearings. Gulf Harmony Oil is rust and foam inhibited and has outstanding resistance to oxidation—helps insure long trouble-free pump and motor life.

Another outstanding installation of power plant equipment for which a Gulf quality lubricant was selected! Make sure <u>your</u> plant is getting the advantages of all recent developments in scientific lubrication. Write, wire, or phone your nearest Gulf office today and ask a Gulf Lubrication Engineer to call.

Gulf makes available top quality passenger and truck tires—Ask your Gulf representative

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Be sure. Specify - "outside to be Tygon-coated."

Tygon Plastic Paint Coatings have been proved by years of exposure to such corrosives as sulphuric, hydrofluoric, nitric, hydrochloric, sodium hypochlorite, potassium hydroxide (in fact, Tygon Plastic Paint Coatings will resist the fumes of virtually all acids and alkalies except glacial acetic and fuming nitric).

Tygon Paint is inert to most alcohols, to fresh or salt water, to oil and grease . . . stands up under abuse that quickly kills ordinary coatings.

other things about Tygon Paint Coatings you'll like: no cracking, checking or crazing; a really flexible film that "gives" under impact without chipping or flaking; high electrical insulating properties; a film that is non-toxic, non-

Tygon Plastic Paint Coatings are available in colors, too: white, red, gray, green, aluminum, black and clear.

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Your own maintenance crew can essily use Tygon Plastic Paint Coatings to protect walls, structural steel, roak exteriors, fune hoods and ducts, etc. Apply by spray gon or brush—air dries quickly. Use on wood, metal or concrete. Write today Would you like a free test sample? Write today



contaminating and non-flammable.

# THE Chementator

#### COMMENTS ON THE NEWS OF CHEMICAL ENGINEERING IN INDUSTRY

#### October 1949, Volume 56, Number 10

#### Competitor for nylon?

Monsanto and American Viscose have teamed up and organized a new company—Chemstrand, Inc. Its object: production of a new synthetic fiber that will compete with nylon.

Little has trickled out about the new fiber. Talk is that it is 85 percent acrylonitrile. What the other 15 percent may be is still a deep, dark secret.

Grapevine has it that Monsanto is arguing for a plant at Texas City, while American Viscose wants it in Virginia. A factor involved: the plant will need plenty of natural gas.

Since the new fiber has yet to be market-tested, odds are that Chemstrand's first move will be to put up a pilot plant.

Industrial Rayon is another company working hard on a nylon competitor. The company will not discuss its work, but a year and a half ago it hired Herman A. Bruson to head up synthetic fiber work. It was said then that Bruson had been given essentially unlimited facilities to do the job—but a time limit of four years. He is said to be working with acrylonitrile, too.

Other companies working with acrylonitrile include Du Pont and Carbide. Du Pont, of course, is nearing commercial reality of its all-acrylonitrile fiber, Orlon. Carbide is supplying the trade with pilot plant quantities of its Vinyon-N (Chem. Eng., Mar. '48, p. 120), a copolymer of vinyl chloride and acrylonitrile. Although meeting with increasing acceptance, little possibility of greatly increased production, on the scale of nylon, is foreseen.

#### Novel hydrogenation process

An installation just completed at the Los Angeles plant of W. C. Hardesty Co., Inc., producer of fatty acids, features a unique hydrogenation process. Two things are unusual about this process.

SELECTIVE—First of all, the process used is selective hydrogenation, utilizing fatty acids instead of the commonly used glycerides.

HYDROGEN FROM AMMONIA—Second feature of Hardesty's hydrogenation installation is its source of hydrogen. Anhydrous ammonia is dissociated to get the hydrogen. Drever Co. of Philadelphia designed and installed the dissociating and ammonia-handling equipment. Patterson Foundry & Machine Co. cooperated with Hardesty on the laboratory and pilot-plant work that preceded the design of the equipment required to meet critical conditions in the handling of fatty acids. It took Patterson more than a year to fabricate the equipment.

The new hydrogenation process makes possible production to precise specifications, with greater purity, uniformity and heat stability. Poly-unsaturates can be eliminated or lowered to requirements through the new process.

#### Big titanium ingots coming

Already making 65-lb. titanium ingots, Allegheny Ludlum expects to produce 400-lb. ingots by the end of this year. With a large order for titanium forgings to be used in gas turbines on its books now, Allegheny is also ready to take orders for wrought titanium in any form.

Allegheny is asking a steep price, about \$20 a lb, for strip. But within a few years the company hopes to cut the price drastically. Eventually, titanium will probably be competitive with stainless steel.

Pure titanium is as strong as stainless steel but weighs only 60 percent as much. It has greater resistance than stainless steel to corrosion by salt water and acids. Even more important, it has a much higher heat resistance. This makes it a strategic metal in the age of jet propulsion and nuclear fission. Titanium fills the wide gap between light aluminum and heavy steel.

Until now, Allegheny Ludlum had kept mum about its interest in titanium. Now it appears that Allegheny is out in front of the pack in the highly competitive new titanium field.

#### Trust-busters go after chemical companies

Anti-trust activity is stepping up. For one thing, the trust-busters have about 300 lawyers in their corps now—100 more than they had a couple of years ago. What is more, the Republican 80th Congress boosted the anti-trust appropriation by 40 percent to a new high of \$3.4 million. And this Congress is keeping the kitty up there.

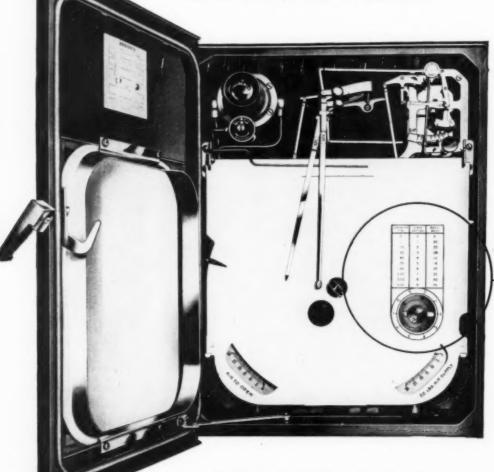
For another thing, anti-trust chief Herbert Berg-(Continued on page 70)

### WITH BRISTOL'S <u>NEW</u> CONTROLLERS

A new standard in automatic control . . .

A new opportunity to produce any desired control action with infallible accuracy . . .

A new degree of assurance that those actions will be produced or duplicated exactly by a simple dial adjustment...



BRISTOL'S Series 500 Air-Operated Controllers for temperature, pressure, flow, liquid level

### These Features are NEW and EXCLUSIVE

### WITH BRISTOL'S SERIES 500 CONTROLLERS



### RESET, DERIVATIVE AND PROPORTIONAL TIME VALUES REPRODUCIBLE

Adjustments are accurately calibrated and exactly reproducible. Similar settings in any Series 500 Controller will produce exactly the same values.

This means that you can standardize controller adjustments for any given process throughout a plant or throughout a national organization. It also means you can replace controllers on a process with full assurance that such replacements will exactly duplicate the performance of the original.

No more cut-and-try to arrive at the original setting...saves hours by reducing shutdown time.



### SIMPLEST CONTROL SYSTEM TO SERVICE

Only one service adjustment is needed. The control units and parts making up the control system are so accurately designed and tolerances are so closely controlled that the system can be completely disassembled and reassem-

bled, even with replacement parts, with only one simple adjustment needed to put the system in exact calibration.

Almost anybody can service a Bristol Series 500 Controller.



### ALL RESET CONTROLLERS HAVE RESET ACTION STOPS

Ask about this new advancement in automatic control.

| DERIVATIVE | SCALE<br>SETTING | RESET |  |
|------------|------------------|-------|--|
| 0          | 0                | 0     |  |
| .1.        | 1                | .03   |  |
| .15        | 2                | .05   |  |
| .25        | 3                | .08   |  |
| .40        | 4                | .12   |  |
| .75        | 5                | .18   |  |
| 1.20       | 6                | 25    |  |
| 2.00       | 7                | .35   |  |
| 3.00       | 8                | .50   |  |
| 5.00       | 9                | .75   |  |
| 7-6-       |                  | 2     |  |

Reset rate and derivative time adjustments are calibrated in equal percentage (or logarithmic) steps. Changes of one step up or down from any setting will produce a change which is a constant percentage of the previous setting—the most convenient way to calibrate an industrial adjustment.

With these calibrated adjustments, you can positively reproduce, at any time, any previously-established control action . . . by merely duplicating the settings on the scales—in the same or in any like Series 500 Controller.

Five types of control: on-and-off, proportional, proportional plus derivative, reset, reset plus derivative.

Investigate your new opportunity for accuracy and uniformity in automatic control, Write us for new bulletin. The Bristol Company, 109 Bristol Road, Waterbury 91, Conn. (The Bristol Co. of Canada, Ltd., Toronto, Ont., Bristol's Instruments Co., Ltd., Lynch Lane, Weymouth, Dorset, England).



### THE CHEMENTATOR, Continued

son is turning his legal eagles loose on the biggest game he can find. Bergson takes pride in the cases he has filed since he got the job in June last year, such as the whopping Du Pont-General Motors-U.S. Rubber action.

Big court battles are slated for this fall and winter in federal courts throughout the country. Among those of interest to the chemical process industries are the actions against Imperial Chemical Industries, Ltd., and Du Pont, against the U.S. Alkali Export Association, and against Du Pont-General Motors-U.S. Rubber. These cases are not likely to be delayed, as they have been, by crowded court calendars. Reason: Congress has just authorized the appointment of 21 new district court judges and 6 new judges in courts of appeal. The new totals: 212 and 59 respectively.

Scheduled for trial in New York around the first of April is the government's cartel case against the British ICI, Du Pont and Remington Arms on charges of allocating territories and fixing both quotas and prices on firearms, ammunition and chemicals.

Recently the government won a decision in New York, when the first court interpretation of the immunity given to export trade associations by the Webb-Pomerene Act of 1918 was handed down.

The U.S. Alkali Export Association entered into agreements allocating world markets with foreign producers of sodium bicarbonate, soda ash and caustic soda. The exporters claimed that such agreements were immune, under the Webb-Pomerene Act, from the anti-trust laws.

But Judge D. J. Kaufman held that the Webb-Pomerene Act, while allowing U.S. exporters to get together to foster competition in world markets, does not permit them to get together with foreign producers to stifle competition.

Hearings this winter will determine what specific arrangements the alkali eporters may make.

In one of the biggest anti-trust cases ever filed, the government seeks to sever the ties that the Du Pout company and the Du Pout family have with GM and U.S. Rubber. It will be months before this case comes to trial.

### Rubber patent pool ending

The government pool of patents and know-how on synthetic rubber has ended—unofficially but effectively.

Rubber companies are now free to take out patents on their own account and to develop their own techniques for the first time since December 1941. Research findings on synthetic rubber were ordered pooled at the start of the war to speed development. Further, ending of the patent pool should soon bring onto the market new special synthetic rubbers—to team up with oil-resistant neoprene, butyl for inner tubes and the government's new cold rubber for tire treads.

Conclusion of agreements with the Canadians also partners to the pool—is the only item holding up official announcement of the cancellation.

Terms already have gone out for signature to U.S. participants. Termination date is retroactive to March 31.

### Foundation bill pigeonholed

Representative James W. Wadsworth, New York Republican, declares that the Rules Committee of the House will take no action on the National Science Foundation bill (H.R. 4648) during this session. This is despite the fact that it has been proposed to limit appropriations for the foundation to the sum required for organization and administration during its first year.

Wadsworth's proposal that the measure be pigeonholed has been accepted by J. Percy Priest, Tennessee Democrat, author of H.R. 4648. And, it is reported, the President has also accepted the proposal.

Under the circumstances, it is difficult for Representatives Wadsworth, Christian A. Herter, Massachusetts Republican, and Adolph J. Sabath, Illinois Democrat, to justify their opposition to the foundation on the grounds of economy. But no other reason has been given.

### Chrome and chromate hazards

With its Donora smog report out of the way, look for the U.S. Public Health Service to come up soon with a report on hazards in the chromate industry. A study was requested by the industry last year, but it was put aside in favor of the all-out investigation of air pollution at American Steel & Wire's zinc works.

### Import controls on tung oil

Secretary of Agriculture Charles F. Brannan has initiated steps to impose import controls on tung oil. This move to control dumping of foreign tung oil and other fats and oils on the U.S. market has the backing of Senators Claude Pepper, Florida Democrat, and John C. Stennis, Mississippi Democrat. The Tung Growers Council of America is also behind it.

Tung oil is included in the Anderson agricultural bill that provides 60 to 90 percent of parity for tung nuts. The bill is slated to come up for a vote in the Senate is soon as the reciprocal trade agreements measure is disposed of.

Meanwhile, the price of tung oil jumped recently to 25 c. a lb. in tank cars after a slump last summer to

(Continued on page 72)

SODA ASH CHLORINE CAUSTIC SODA

# important additions

### PARA-DICHLOROBENZENE

All standard mesh sizes Packed in 25, 50, 100 and 200 lb. fiber drums

### ORTHO-DICHLOROBENZENE

55 gallon drums 8,000 gallon tank cars

### MONO-CHLOROBENZENE

55 gallon drums 8,000 gallon tank cars

SODIUM BICARBONATE CALCIUM CHLORIDE CAUSTIC ASH MODIFIED SODAS



MURIATIC ACID SODA BRIQUETTES (Iron Desalphurizer) PHOSFLAKE (Bottle Washer) HI-SIL (Hydrated Silicate) SILENE EF (Hydrated Calcium Solicate) CALCENE T (Precipitated Calcium Carbonate)

PITTCHLOR (High Test Calcium Hypochlorite)

PITTCIDE (Special Calcium Hypochlorite)

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These three chlorinated benzenes are the newest products manufactured by Columbia . . . a natural development from the position of Columbia and its affiliate as the nation's largest merchant producers of liquid chlorine. Your requirements for alkalies or related specialties, as listed above, can be met promptly and, in many cases, with other definite advantages to your business. Get the facts by contacting any district office, or Pittsburgh Plate Glass Company, Columbia Chemical Division, Fifth at Bellefield, Pittsburgh 13, Pa.

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PLATE GLASS COMPANY

### THE CHEMENTATOR, Continued

18 c. Stocks of tung oil are reported at a 10-yr, low of 12 million pounds, with consumption about 7 million pounds a month.

Very little oil is coming in from China. But Argentina, according to government reports, recently sold 6,600 tons of tung oil to the U.S. for October and November delivery.

Lamont Rowlands, chairman of the legislative committee of the TGCA, believes that import controls will go further toward solving the industry's problems on a permanent basis than most other avenues of relief the industry has tried.

### Impact of devaluation on chemicals

How will devaluation affect world trade in chemicals? Chemicals coming into the U.S. for which the supply is greater than the demand will fall in price, though probably not by the same percentage as the currency was devalued.

The old dollar price or higher will prevail for U.S. imports for which the demand is equal to, or greater than, the supply. Pound sterling prices of tin, copper, lead, zinc and aluminum, for example, have been raised to the old dollar rate.

When it comes to U.S. sales of chemicals abroad, American producers are faced with the fact that their products, which they must sell for dollars, have been raised in price by the extent of devaluation in the country of sale. This means the foreign buyer will have to pay up to 30 percent more for the U.S. chemical products than he will for the same commodities bought in another soft-currency country.

Even though this is an added incentive to try to buy non-American, chances are the buyer has already exhausted most other sources. So he must take the U.S. products or close down his plant.

This means that, while devaluation may depress U.S. chemical exports somewhat, the over-all loss of foreign markets probably will not be very much. Besides, so long as the U.S. is even a marginal supplier, the high non-dollar prices will tend to act as support prices for the rest of the world, thus lessening delivered price differentials.

### Canadian venture for General Anillne

Formation of a Canadian company known as Chemical Developments of Canada, Ltd., jointly owned by General Amiline and Standard Chemical Co., Ltd., of Canada, is revealed by General Aniline's Fresident Jack Frye. The new company will utilize General Amiline's know-how and assigned patents to produce organic chemicals not heretofore made in Canada.

First products to be manufactured by Chemical Developments of Canada, Ltd., will be a group of synthetic non-ionic detergents made from ethylene oxide. Engineering and design of a new plant to produce these detergents is well advanced.

Authorized capital of Chemical Developments is \$14 million. Stock ownership is divided between the originating companies, with Standard Chemical holding 51 percent and General Aniline 49 percent.

### Refinery operators are supervisors

SUPERVISORS—Operators in the chemical division of a refinery have been declared "supervisors" by the National Labor Relations Board. They are therefor ineligible, under the Taft-Hartley Act, for membership in the bargaining unit with other employees. Part-time operators, who work one day a week as operators and as helpers the rest of the time, have also been declared to be supervisors.

The NLRB made this ruling when the CIO Oil Workers International Union sought to represent certain of the employees of Pan American Refining

DEGREE OF AUTHORITY—Crux of the matter is the degree of authority exercised by an operator. While on the night shift, the operator is in full charge of all operations. He checks functioning of equipment, and he has authority to call out maintenance men in the event of a breakdown or other emergency.

Moreover, the operator has the power to change the assignments of the nine men working under him, to discipline them for breach of rules, to grant time off when necessary and, effectively, to recommend raises or discharges. He spends from two-thirds to three-fourths of his time supervising other shift employees.

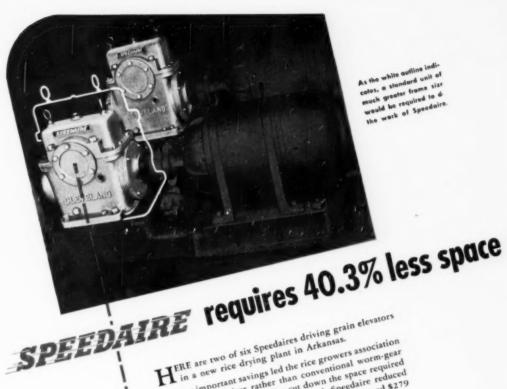
ELECTION ORDERED—NLRB ordered an election for all production and maintenance employees to determine whether or not these employees wish to be represented by the OWIU. Excluded are office and clerical employees, guards, operators and all other supervisors.

### Strike at Jefferson's Port Neches plant

When the CIO Oil Workers International Union called a strike of production employees there on September 7, the Port Neches, Tex., plant of Jefferson Chemical was shut down.

The company and the union had been negotiating their initial contract for several weeks. A last minute attempt was made to settle their differences with the aid of a Federal Mediation Service conciliator. When this failed to bring a settlement, the OWIU, representing the production employees, called the strike.

Jefferson has offered the production employees a 15 c. an hr. increase. This would make their rates (Continued on page 74)



As the white autline indicates, a standard unit of much greater frame size would be required to di the work of Speedaire

HERE are two of six Speedaires driving grain elevators in a new rice drying plant in Arkansas. Three important savings led the rice growers association Inree important savings led the rice growers association to install Speedaires rather than conventional worm-gear to install Speedaires rather than conventional worm-gear drives: First, use of Speedaire cut down the space required drives: First, use of Speedaire cut down the space required for the installation by 40.3%. Second, Speedaire reduced the least on the floor 2500. Finally, the company gaved \$270. for the installation by 40.5%. Second, Specuaire reduced the load on the floor 25%. Finally, the company saved \$279

Speedaire is Cleveland's fan-cooled worm gear speed re-Speedaire is Cieveland's Jan-cooled worm-gear speed red ducer. Because it is fan-cooled, Speedaire will do more work ducer. Because it is tan-cooled, Speedaire will do more work
will deliver up to double the horsepower of standard worm in the initial cost. will deliver up to doubte the porsepower of standard worth units of equal frame size, at usual motor speeds. It can be units of equal frame size, at usual motor speeds, it can be installed economically on many applications where other installed economically on many applications where other types have been used heretofore—giving you the advantage types have been used heretotore—giving you the advantage of a compact right-angle drive. Speedaire gives the same on a compact right-angle urive, operative gives the same long, trouble-free service characteristic of all Clevelands. For full description, send for Catalog 300. The Cleveland FOR IMI description, send for Catalog 300. The Cleveland 4, Ohio. Worm & Gear Co., 3273 East 80th St., Cleveland 4, Ohio.

Affiliate: The Farral Corporation, Centralized Systems of Lubrication.



### THE CHEMENTATOR, Continued

higher than the average of chemical industry in the area. This offer was turned down. The union is holding out for 25 c. to 45 c. an hr.

Among other issues involved in the strike are the right of the company to determine the size of the plant working forces and whether the company shall be required to negotiate upon union demand for reduction of the work week from 40 to 36 hr., subject to threat of strike if not settled by negotiation.

### Chemicals from seaweed

Florida Agar & Products, Inc., plans the construction of a \$75,000 plant at East Point, across the bay from Apalachicola, Fla., according to Arthur L. Tucker, Jr., president and manager.

The newly formed corporation will extract agar from seaweed, together with other chemicals yielded from marine grasses.

### Tennessee Eastman moves into Texas

PLANT SITE—Longview, Tex., has finally been picked as the site for the new plant of Tennessee Eastman. The multi-million dollar unit will be located near the Sabine River in Gregg and Harrison Counties.

LABOR SUPPLY—For a time, Victoria, Tex., had been seriously considered as a plant site. But, since Du Pont had skimmed the cream off the labor supply at Victoria for its plant there, Longview, with its large labor force, looked like a better bet.

CONSTRUCTION—Initially, about \$4 million will be shelled out on a plant that is expected to be operating late in 1950. But this unit will occupy only a few of the 2,300 acres that Tennessee Eastman has acquired.

RAW MATERIALS—The city of Longview has agreed to sell water to Tennessee Eastman for 1c. per 1,000 gal.

Proximity to abundant oil and natural gas, sources of ethane and propane raw materials, influenced the decision to build at Longview.

PRODUCTS—Acetic anhydride will be made from ethane via acetylene. This and other chemicals made in Texas will be shipped to the company's Kingsport, Tenn., plant.

Construction of a rayon plant at Longview, to turn out cellulose acetate, is a long way off. So far, no arrangements have been made for bringing in cellulose pulp for rayon making.

### More ammonium sulphate

Finney Chemical Corp. starts producing ammonium sulphate this month at its Houston, Tex., plant. Capacity: 6,000 tons a month.

This company, jointly owned by H. T. Finney

and W. T. Allison, has been turning out solid caustic for Diamond and others.

### Superphosphate plant for Stauffer

Construction of a new \$400,000 superphosphate plant for Stauffer Chemical at Tacoma, Wash., is now under way. When the plant gets going early next year, it will turn out more than 30,000 tons of superphosphate a year.

Stauffer will get phosphate rock for its Tacoma plant from deposits it owns at Sage, Wyo. To get sulphuric acid, Stauffer has contracted for the entire output of the new 100-ton-a-day acid plant of American Smelting & Refining at Tacoma. The AS&R plant utilizes waste stack gases.

### Phenol demand rising

Phenol, hard to get during the war, has been in better supply since December 1948. Now, however, Dow reports that demand has climbed sharply since mid-August.

Right now you can still get plenty of phenol with normal delivery schedules. But the squeeze is on. Some of the crystal-ball boys prognosticate that supplies may tighten up this fall. Accordingly, Dow is planning enough future production of USP phenol to satisfy its regular customers.

### Smart oil men, these farmers

CAT CRACKER—The Indiana Farm Bureau Cooperative Association, Inc., is going to install a fluid catalytic cracking unit at its Mount Vernon, Ind., refinery. The unit, to take 4,000 bbl. of charge stock a day, is being designed and engineered by Universal Oil Products.

MORE HIGH OCTANE—Addition of the cat cracker will enable the farmer-refiners to produce gasoline that could easily meet anticipated future octane requirements for both premium and motor grades.

Besides, the new fluid catalytic cracking unit when teamed up with the present UOP two-coil thermal cracker will substantially increase the refinery's gasoline production. Expected gasoline yield is estimated at 71 volume percent based on the crude charge.

The gasoline will have a Reid vapor pressure of 10 lb. and a distillation end-point of 400 deg. F.

LESS FUEL OIL—Once on stream, the new operation will reduce the refinery's production of No. 6 fuel oil significantly. This will be effected by running part of the capacity of the existing UOP two-coil thermal cracker as a viscosity breaker, charging the reduced crude from the vacuum flashing unit. About 20 percent reduction in No. 6 fuel oil output is expected from this operation.

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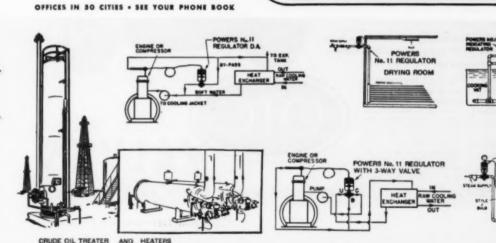
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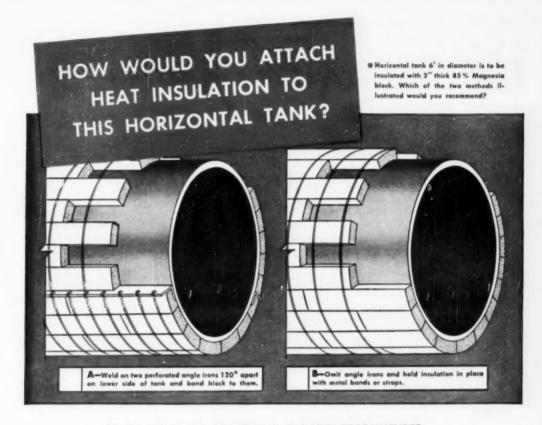
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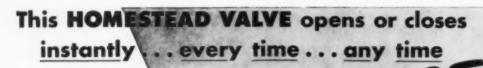
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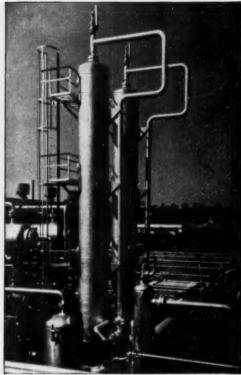
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CHEMICAL ENGINEERING-October 1949



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# For STEEL in a hurry call RYERSON

# Chemical Engineering

### OCTOBER 1949

### Spend to Save

In common with other McGraw-Hill publications, we are currently concerned with increasing emphasis on lower costs and higher productivity. Here is industry's great opportunity for advancing the national economy. Here is the engineer's most challenging responsibility for contributing his specialized knowledge and resourcefulness toward improving the efficiency of plants and processes.

Too often too many of us think of cost cutting, as a defense mechanism. Somehow it connotes contraction, restriction rather than expansion of effort and facilities. Yet we all know that in the long run it takes money to make money. We can profit most as we make more and better goods to sell at ever lower prices. So the job of cutting costs in most of our industries means more efficient methods and equipment, more production per unit of expense, whether in time, labor or materials.

With these thoughts in mind, we present in this issue the beginning of a continuing effort to help chemical engineers make their most effective contributions to increased efficiency in the process industries. To spend wisely is to save wisely—a sound slogan for most of us during the months ahead.

### By Merit or by Law

Lard producers have been very much disturbed by various competitive situations which threaten to reduce the consumption of this product of the packing house. One of the latest worries has resulted from claims that the use of emulsifiers in bread might result in a lowering of the fat content.

We have not believed that any such result is likely. But the packers took no chances. They proposed, through interested Senators, to require that there be not less than 4 percent of natural fat in bread or pastry, or otherwise it would be declared adulterated. Thus they hoped to accomplish by legal restriction in the Food and Drug Act the requirement for use of lard or other "natural fat" that would preclude alternate shortenings, no matter how meritorious.

That proposal, introduced by Senator Gillette as S. 2432, was knocked out almost as soon as it was presented to the Senate. Now other efforts are taking its place. But, withal, it seems to us that the packers and other lard producers would get farther if greater expenditures were made for research on the possibilities of making lard more attractive to the housewife. Markets achieved by merit will be much easier to hold than those obtained by discriminatory statute.

### The Cost of Health

Industry, in the last analysis, pays all of the living costs of its wage earners. It always will. Thus we shall pay directly or indirectly the added costs of any plans for protecting the health of our workers and their families. This gives us a very direct stake in the political controversy over socialized medicine that is just beginning to be important in Washington. It gives us a very real interest in the way the steel industry finally settles its labor problems.

No one has all the answers to the questions we must soon face in this field. But here are two conclusions that seem worthy of at least tentative acceptance:

The American enterprise system and the natural individualism of the American people will not give wholehearted endorsement to mechanized and socialized medicine. It is important, therefore, that the people be guided by facts which will make voters demand the retention of some sort of personalized medical service, at least for all those above the charity class.

While retaining the personalized features of medical service, we must strive valiantly to eliminate those calamity problems which come from unusually high and unexpected medical expenses in the family of moderate income.

We need something for the wage earner and his family like the "deductible" collision insurance we provide for our automobiles. For each wage earner we need some plan that will help out when the aggregate of medical costs in any year exceeds some maximum which is the reasonable upper limit for medical expense for the family of any given financial status. That should be an insurable item of expense. Those who can help workers and management to establish such a limited health insurance program will contribute a timely service right now to American industry.

### Alcohol for Anti-Knock

Alcohol can be used for motor fuel either as a blend with gasoline or to improve engine performance by injection of small quantities into the intake manifold during peak loads. The former use, long proposed valiantly by the chemurgists, still seems impractical of achievement. But injection to reduce knocking and improve performance now seems both practical and, for many motor fleets, to be economically attractive.

The oil industry will have to sharpen its pencils to figure out the economic consequences of alcohol usage as an anti-knock. At the very least it offers something more to sell in the filling station, presumably at a profit. But it may also introduce a new variety of service demands at the same station. It might slightly reduce the total sales of gasoline. More importantly it may make low-octane fuels adequate and attractive to motorists instead of premium grades on which profits may seem greater.

It is not yet clear how the public will take to this auxiliary fuel usage, if at all. But the difficulty of getting enough high-test gasoline increases as the number of cars on the highway with high compression ratios increases beyond all previous records. As the first step in testing this development, an aggressive campaign has already been staged by large fleet operators in the Cleveland area. Work has been underway for some time in the Northern Regional Research Laboratory of the U. S. Department of Agriculture and is currently reported in an interesting bulletin (AIC-240).

It is expected that through such studies the uncertainties and the difficulties in the path of this development may be largely eliminated before the general public demands wide use of injection equipment and auxiliary alcohol fuel. In any event, this development is one that cannot for long be ignored by the petroleum and chemical industries.

### "Farmer Victorious"

We quote a thought-provoking paragraph from a publisher's invitation to buy an autographed copy of a book of this title.

"The headlong greed of industrialists in their plunder of unrenewable resources and their utter blindness to the will of the people who decry such ravages, cannot fail to hasten the day when all natural resources must be taken over by the government. Rapidly the day approaches when the farmer will take command and will save for the nation its irreplaceable reserves through substitution of chemically processed agricultural products. Through this good fortune, farm and factory will be made to interlock; whereupon private enterprise and national prosperity will rise to heights never before dreamed."

No, the author is not a Communist or a Socialist or even a Technocrat. He's the distinguished father of chemurgy in America—our old friend, Dr. William J. Hale, with whom so many of us love to argue. We hope to have more to say about the book when our review copy arrives, with or without the distinguished autograph.

### Must We Be Blamed?

Agricultural production per farm worker is today from two to ten times as much as it was only two or three decades ago. Adequate supplies of low cost fertilizer and the availability of effective pest-control chemicals are two of the major factors which have made possible stupendous production by limited numbers of agricultural workers. These two contributions of chemical enterprise have probably done as much as the mechanization of agriculture in increasing present and prospective surpluses of farm products.

Beginning late last year there was a precipitous drop in prices for oils and fats. Today tallow is in considerable surplus and new uses are earnestly sought. Some commentators have tried to lay the blame at the door of the soap and oleomargarine industries. Others have pointed out that the rise of synthetic detergents has adversely affected the market for farm products.

But to argue that for these reasons there should be an abandonment of the benefits of science would be both economically and socially absurd. Tremendous contributions and effective application of chemical research and engineering developments represent advantages in labor saving and service value to the people of the world. These advantages must be retained even though they cause inconvenience or hardship temporarily to those who profited from the old situation. This is not the time nor place in which to offer complete remedies or corrections. But it is the appropriate time for us to emphasize one important thing that should not be done.

It is certainly not justified that the relief measures which cushion the impact of these great changes should take such form as to continue old habits and practices that merely aggravate the surpluses. Any benefits for farmers who have surplus problems must be so set up as to discourage and taper off those crops in excessive production. To this extent it is proper to suspend briefly the more drastic effects of the law of supply and demand. But it is neither sensible nor safe to assume that Congress or anybody else can repeal that basic law of human psychology and behavior.



THROUGH HIGHER PRODUCTIVITY, PROCESS INDUSTRIES PLAN FOR

# CUTTING COSTS

Here, in a group of six articles, to be followed by other articles in later issues, policy makers in the process industries will find many ideas that will aid in the productivity-raising, cost-cutting job ahead.

### CHEMICAL ENGINEERING REPORT—OCTOBER 1949

A THE chemical process industries plan for 1950 and the future, they find that all manufacturing industries are facing a common problem-relatively low productivity and high costs. Going back to primary causes, they find that wages have outstripped productivity, and production costs have gone up faster and farther than the selling prices of the products they make. Hence we have had industrial uncertainty, considerable declines in business in some lines, and a modest increase in unemployment.

Now, fortunately, the unemployment trend seems to have started a reversal. Business is beginning to pick up in some industries. If dire things to come is still the prediction of certain economists, others believe the corner has been turned. With good management-and

good luck-they feel that a long period of prosperity can ensue. It seems to us that we are on a balance point, where business can go either way. Of course, industry cannot influence many uncertainties in the international situation. And there is still the element of "luck"—the imponderables in economics.

Still, industry's hands are not tied. A con- Industry certed effort toward restoring the essential bal- can ances between productivity and wages, costs 90 ahead and prices, can go a long way on the road to good management, and toward making certain that the "luck" will be good. If the first job of increasing productivity is taken care of, the other factors should largely fall into line. As a start toward this necessary goal we strongly commend the articles on the following 15 pages.

000 balance point

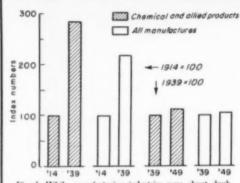


Fig. 1-While manufacturing industries were about doubling productivity from 1914 to 1939, chemical industries scored a three-fold gain. Since 1939 productivity has improved but slightly in both industry groups.

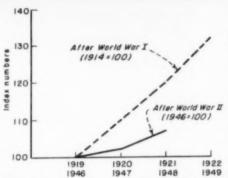


Fig. 3-Postwar effects on productivity of manufacturing industries differed markedly: after World War I productivity shot upward at over 10 percent per year; gain has been slow since World War II.

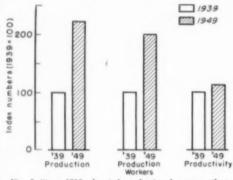


Fig. 2-Since 1939 chemical production has more than doubled, chemical production workers have just doubled. but only a slight increase in output per worker (productivity) has been registered.

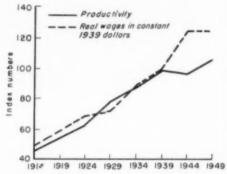


Fig. 4-Productivity and real wages (living standards) advanced together from 1914 to 1939; since 1939 wage advances have put wages well ahead of gains in productivity of manufacturing industries.

Sources: Federal Reserve Board, Bureau of Labor Statistics, Factory Management and Mointenance Magazine, and 1949 estimates by McGraw-Hill Department of Economics.

# To Lower Costs Industry Must Raise Its Productivity

Only through increased efficiency and productivity can profit levels be restored and living standards be maintained

PETER FRENCH, Department of Economics, McGraw-Hill Publishing Co., Inc., New York, N. Y.

Is progress in the chemical process industries slowing up?

Chemicals

In the years before the war the chemical inset poce dustry was one of the pace-setters in improving efficiency. By installing new equipment and introducing new methods and materials, it improved its performance year by year-turning out more production per man-hour worked. While

all manufacturing industries roughly doubled their productivity (i.e., production per manhour) between 1914 and 1939, the chemical industry almost tripled its productivity (Fig. 1).

This outstanding performance by the industry And cut was a major contributor to its growth. It al- costs lowed the industry to cut its costs and prices, raise wages steadily, and still to plow back a

majority of its earnings to expand and improve its plants and new equipment.

The industry's performance in tripling its efficiency also contributed importantly to the steady rise in American living standards. The fact that the United States has the highest living standard in the world is possible only because American industrial productivity is far ahead of other nations. Over-all productivity of American industry is twice that of Great Britain, three to four times the level in Belgium, France, and other European countries, and probably eight times Russia's.

The American worker's higher living standard is possible only because-working with better equipment-he can turn out twice as much in in hour as does his British counterpart, or eight times as much as a Russian industrial worker.

The war, however, sharply set back industry's efforts to increase its efficiency

War cut

In the years just before Pearl Harbor, indusefficiency try improved its productivity at an average rate of better than 3 percent a year. But the war demanded production at any cost. Equipment and plants that had become obsolete began to roll once more at full capacity. Housewives and youngsters with no industrial experience went to work in plants all over the country. Research and development were concentrated on war products. The result: instead of improving its efficiency. American industry actually saw it slip back in the war years. By the end of the war, productivity was well below the 1940-41 level, probably back to about where it was in 1938.

> In the postwar years-when pressing shortages of almost everything again encouraged production at any cost-productivity was slow to rise. The war, with all the changes in products and methods and volume of business activity that came with it, upset all the standard methods of measuring productivity. But most economists would agree that it was not until some time in 1947 or 1948 that productivity got back to its

1941 level.

The war's adverse effects on the ability of the chemical industry to improve its efficiency were greater proportionately than for manufacturing as a whole. Where the chemical industry had been a pace-setter before 1940, its productivity increase apparently was slowed down to about the average of all manufacturing industries.

This comparison can be only a rough estimate. There are, as vet, no precise postwar figures on productivity in either the chemical industry or manufacturing as a whole. best, the figures cannot reflect changes in products or improvements in quality, and they conceal what may be outstanding records in individual companies or parts of the industry.

But-apart from the comparison with other industries-the rate of progress within the industry itself has slowed down. During the 1930's the industry was improving its productivity at a rate of 5 percent a year. Since 1939, however, the average gain indicated in Fig. 2 is about 1 percent a year.

The lag in chemical industry efficiency has not come because the industry has not spent money on new plants and equipment since the war. The 1949 survey of Business' Needs for New Plants and Equipment, carried out by McGraw-Hill, shows that the chemical industries spent \$1.4 billion in 1948 and will spend almost as much in 1949. Moreover, the industry has plans to maintain its capital expenditures at almost that level over the next four years.

One reason for lagging productivity, and per- Since '45haps the major reason, is that since the war exponsion the industry has had to concentrate on expansion. In 1948, for example, 64 percent of its plant and equipment expenditures went primarily to expand capacity, rather than to replace and modernize older equipment and processes. In the years ahead the industry, according to results of the McGraw-Hill survey, plans to put about half of its funds into replacement and modernization. Money spent that wayfor example, in converting batch processes to continuous, automatically-controlled processes can sharply raise the industry's productivity.

Then, too, competition has increased sharply this year. Its pressure can be expected to be still more intense next year. The chemical industry-and all industry-has a much greater incentive to better its efficiency than it had in

the years right after the war.

Why does industry need to concentrate on But now

raising its efficiency?

Before the war productivity was taken almost for granted. It was considered an almost automatic byproduct of industry's day-by-day operations. Productivity moved up steadily as industry developed and installed better ways of doing things. After the first World War-which also stymied progress in better efficiency for a few years-productivity surged forward. In the early 1920's, for example, Fig. 3 shows that manufacturing industries bettered their productivity at a rate of more than 10 percent a

But World War II brought no such surge in its wake. Note the contrast in Fig. 3. Part of the explanation is that the second war demanded a much bigger effort from industry and piled up much bigger shortages. Industry had to concentrate on production-more production at any cost-for years.

The lag is now so great that we can no must be longer take productivity for granted. To meet overcom the demands on industry for the goods and services that make possible higher living standards, better social welfare services and world rehabilitation, productivity will have to increase

What has been the effect of the second postwar period on the usual balance between productivity and real wages? Fig. 4 shows what has happened since 1914. Up to 1939 productivity, and real wages (wage rates adjusted for changes in living costs) moved upward in substantial balance. During and since however, wages have gone well ahead. During and since the war,

Does better productivity mean fewer jobs? Over the long run-and the chemical industry is a fine example of it-improving efficiency has meant more jobs, not fewer. In the last century, the Twentieth Century Fund estimates, productivity in the United States has been multiplied five times. But in that time our total national output has multiplied 27 times. With about eight times as many workers, each

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working about a 40-hr. week instead of a 70-hr. week, the United States is producing 27 times as much as it did 100 years ago. To turn out as much as we do today, with productivity at the 1850 level, would require three times as many people, each working almost twice as many hours as at present.

The evidence is clear: In the long run investment in new plants and equipment raises productivity, raises living standards, and creates new jobs. For industry, it lowers labor costs and prices and expands markets.

In the short-run capital investment is just as important. Over the years the record shows that the United States has had good business generally when industry was investing at a high level in new plants and equipment. As capital expenditures go, so goes prosperity.

## Management Engineering Can Pay Off

A timely article describing the organization of a management engineering department, and how it cuts costs

JACKSON D. LEONARD, Senior Engineer, E. I. du Pont de Nemours & Co., Houston, Tex.



In the last decade, plant management has faced an imposing array of difficulties in performing its task of "producing the maximum of good quality production at lowest possible cost." Governmental controls on materials, the increasing unionization of labor, increased cost of materials and labor, price controls on products, and increased taxes are but a few of the factors that have increased production costs.

In order to offset these external adverse cost What influences, management has been forced to it is utilize every known "tool," and develop some additional new tools as well. These devices, both new and old, have been grouped together under the term "Management Engineering."

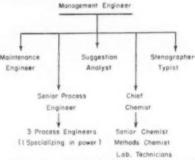
Management engineering is known in piecemeal fashion by most of the chemical industry under the names industrial engineering, process engineering, etc. These groups solve individual problems, but few companies have made any attempt to build an integrated team to attack the cost problem.

Briefly, management engineering is the art Its job of refining, improving, and reducing the cost is to of operating an established chemical process; sove the cost sheet is its direct measure of success and progress. Improved quality of product, bet-ter working conditions, and improved safety are its secondary results, and sometimes count for more than the cost sheet dollars

To illustrate more fully the place of the Status management engineer in modern chemical industry, let us examine in detail how a modern management engineering section is organized and functions. First, and most important, is the organization position. In order to be most effective, the management engineering group must enjoy equal status with the other departments in the plant.

Such organization would insure that technological ideas and improvements would share equal consideration and discussion along with the other important phases of plant operation, and would also have an equal voice in the formulation of overall plant policy. Too often, the technical departments are subjugated to the production department.

Having established the equality of the man- Internal agement engineer, the next most important organizestep is to have the internal organization of the tion department arranged to effect maximum per-formance. The number of people in such a group will, of course, vary with the size and complexity of the plant. However, a rough rule of thumb which will hold true for many chemical plants, is that one technical engineer can be effectively employed for each \$1,000,000 of investment. Thus a \$10,000,000 plant employing 500 to 600 people would have a management engineering section organized about as follows:



Note that the chief chemist and control Departlaboratory are placed under the management ment engineer. This is done for several reasons: first grouping to insure that equally good service of high caliber will be extended without discrimination to all the operating departments, and secondly, to insure that technical samples are serviced as needed. All too often, the control laboratory is placed under the direction of the operating department, so that technical samples are delayed, or hurriedly "squeezed in" with other

work so that a technical program is delayed. Table I-Management Engineering Personnel or based on poor or inadequate analytical results.

A necessary part of the organization picture is the type personnel needed, and their salary scale. The evaluation in Table I represents the writer's own opinion based on field experience. Obviously, some plants will require more specialized personnel, but this tabulation will fit a majority of present day plants.

Cost vs. Thus, the minimum annual cost of the orsavings gamization recommended for the average \$10,-000,000 plant would be about \$48,000 exclusive of the chief chemist and control lab technicians whose costs would be largely chargeable to operating expense. The minimum total experience or know-how would be 48 years plus 39 years of college educational training. The minimum amount which a well coordinated group of this size should save (or reduce costs by) would be \$250,000, and the maximum about \$500,000 per year. So that on a straight dollar basis, it can be readily seen that management engineering is a profitable business.

> improved product quality, improved working conditions, and improved safety are added on, the picture becomes doubly attractive.

When the other intangible benefits such as

Let us now examine in some detail how results such as these are obtained. As a first step, the manufacturing costs of each operating unit are carefully analyzed, and standard cost goals developed for each separate item of cost. This initial analysis will require a detailed study of the process, calculation of theoretical consumptions and units, and comparison against past performance. This survey may reveal some alarming inaccuracies in cost accounting and plant charging procedures. In a certain plant where such a study was made, the cost books showed that three interrelated processes A, B, and C were all just moderately profitable. When the true cost picture was untangled, Process A was found to be very profitable, Process B moderately so, while Process C was actually a serious money loser. The attention of the management engineering group was immediately focused on Process C with the result that within a year's time, sufficient improvement had been made to bring it onto the "black" side of the ledger. At the same time, some much needed capital expenditures which it had been previously impossible to justify for Process A, were now easily justified, and the business in this commodity greatly expanded. Obviously, such a cost study can only be properly performed by an experienced process engineer as the establishing of yields, budgeting of utilities and labor, standardizing packaging and shipping costs requires technical skill, common sense, a thorough knowledge of plant operations, and good judgment. All too often so-called standard costs are established by an accountant, elerk, or top executive who has no real knowledge of the operation and its problems, and no real knowledge of whether the standards are right, or wrong.

Monthly comparison

How job

is done

Once the initial standard costs for each operation have been established, and the basis for each cost element thoroughly explored, then each month the standard costs must be reviewed

| Position                   | Preferred<br>Minimum<br>Education* | Desirable<br>Experience  | Salary<br>Range      |
|----------------------------|------------------------------------|--|----------------------|
| Management<br>engineer     | B.S. in<br>Ch.E.                   | 10-15 years varied<br>plant experience<br>including at least<br>5 yr. production<br>supervision.                   | \$8,000-<br>\$12,000 |
| Senior process<br>engineer | B.S. in<br>Ch.E                    | 7-10 years varied<br>plant experience<br>including at least<br>3 yr. production<br>supervision.                    | \$6,000-<br>\$8,500  |
| Maintenance<br>engineer    | B.S. in<br>M.E.                    | 7-10 years varied<br>plant experience<br>including at least<br>3 years in mainte-<br>nance supervision.            | \$6,000-<br>\$8,500  |
| Process<br>engineer        | B.S. in<br>Ch.E.                   | 3-5 years varied<br>plant experience<br>including at least<br>2 yr. production<br>supervision.                     | \$4,000~<br>\$6,000  |
| Chief<br>chemist           | B.S. in<br>Chem.                   | 7-10 years varied<br>laboratory experi-<br>ence including at<br>least 3 years in a<br>plant control<br>laboratory. | \$6,000-<br>\$8,500  |
| Senior<br>chemist          | M.S. or<br>Ph.D. in<br>Chem.       | 3-5 years varied<br>laboratory experi-<br>ence.  | \$5,000-<br>\$7,000  |
| Methods<br>chemist         | B.S. in<br>Chem.                   | 2-3 years varied<br>laboratory experi-<br>ence including at<br>least 1 year in a<br>plant control<br>laboratory.   | \$4,000-<br>\$6,000  |
| Suggestion<br>analyst      | B.S. in<br>Ch.E.                   | Same as process engineer.  | \$4,000-<br>\$6,000  |
| Lab. tech-<br>nicians      | High<br>School                     | None needed.   |                      |

Note that in only one case is a degree higher than a Bachelor's recommended. It is believed that plant experience is the best "higher education" for manage-ment engineering work, and that Masters and Doctors degrees are chiefly of value in research or develop-ment work.

and revised for the coming month, and a comparison made between the standard and actual costs for the past month. Deviations of the actual cost from standard on each cost element amounting to \$50 or more should be investigated and the reason for the deviation determined. This monthly comparison can be performed in a matter of a few hours, but can succeed in paying large dividends.

After the cost standards and comparisons have been started for each process, the real job of cost reduction is begun somewhat along the

lines of Table II.

In addition to this direct cost sheet attack, the suggestion analyst is used to handle all supervisory and staff member suggestions. If a suggestion system of this type does not exist, it should be established as many fruitful ideas will be advanced by alert supervision. The management engineering section is the best qualified department to handle these suggestions and get the utmost benefit from them for the company, and also the suggestor. Adequate rewards should be paid to all successful suggestors in order to stimulate the flow of these improvement ideas.

The advantages of such a coordinated management engineering program will show up first on the cost sheet, but will also appear in the form of improved morale and company loyalty. Likewise, the maximum results will be obtained for the least expenditure of money.

### Table II-Program for Cost Reduction

I. Raw Materials (Process Engineers, Senior Chemist)

(a) Yields are first carefully studied to determine possible improvements; (b) Substitution of cheaper materials in place of those being used, or chemical refinements to the process to decrease consumptions are made the prime responsibility of the senior chemist who can pursue an orderly program of exploration along the indicated lines; (c) Better means of unloading and handling the raw materials into process are another savings source.

II. Operating Expenses

1. Labor (Process Engineers)

(a) Standard operating labor requirements are determined in cooperation with operating supervision. Once established, a daily time office report will quickly show up any serious deviation, and permit rapid correction. (b) Long range studies to mechanize or eliminate high labor portions of the operation are begun.

Utilities (Process Engineers, Power Specialist)
 (a) Metering of all major utilities such as elec-

tricity, steam, fuel oil, water, vacuum, and compressed gases forms an ideal basis for establishing utility budgets for eliminating waste; (b) Where metering is too expensive, a system of spot checking can be developed and incorporated into operating procedures to effect reductions; (c) In addition, recovery and reuse of waste utilities can also be extremely lucrative.

3. Control Laboratory (Process Engineers and Methods Chemist)

(a) Statistical analysis plus common sense review of analytical requirements can oftentimes effect remarkable savings; (b) Review of the analytical methods by the methods chemist can result in shortening and simplifying them.

4. Maintenance (Maintenance Engineer)

(a) In the average chemical plant, maintenance expense comprises an appreciable percentage of the unit cost, and thus deserves special treatment. In recent years, several special methods have been developed to reduce maintenance costs. Best of these is planned maintenance. This is a newly developed method of coordinating the activities of the maintenance department so that the proper craftsmen, the right tools, and the necessary materials arrive on the job at the right time to achieve necessary repairs; (b) A second "tool" is maintenance engineering which, briefly, consists of individual studies of maintenance methods, organization, and tools; (c) Both of the foregoing plans along with a good salvage and reclamation operation can do wonders for maintenance costs.

5. Packages (Process Engineers)

So many improved packaging methods, and new types of containers have been developed in the last 5 years by the industry leaders, that it is safe to say that much of the industry is out-of-date. Yet although this is one of the most important phases of the unit operation, all too often it is completely ignored. Good packaging can sometimes sell the product when all else fails.

6. Shipping (Process Engineers)

New material handling techniques, if properly applied to the warehousing and shipping end of the process, can effect substantial savings, and improve service to the customers.

III. The Overhead Block (Process Engineers)

The overhead block on the average cost sheet usually carries some strange and wonderful items in addition to the usual taxes, insurance, depreciation, clerical, supervision, etc. A careful combining of each of these items can sometimes produce golden results: overlapping insurances, fees for legal services covered by insurance, unadjusted depreciation, etc. are but a few of the items most often neglected to the detriment of the cost sheet.

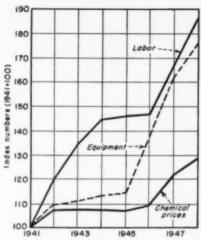
# Revamping Offers First Aid To Marginal Processes

Processes which no longer pay owing to labor cost increases can often be revamped and returned to profitable operation DONALD Q. KERN, The Potterson Foundry & Machine Co., New York, N. Y.

In the period since the war the trends in costs and prices have been such that many chemical manufacturing processes have become marginal. Labor costs in particular have increased, while selling prices have by no means kept pace. Unless steps have been taken to correct the disparity, in many cases this has meant the serious shrinkage or even disappearance of profit margins. Fortunately, as this paper will show, a solution can be achieved for most such processes through "revamp engineering," with the result that the percentage of labor entering into the manufacturing cost can be substanti-

ally reduced, usually with only very minor expenditures for additional equipment.

. How has the problem come about? Many of the processes that have passed from a profitable status in recent years can attribute their deficits to the changing relationships between the cost of chemical plant labor and the selling prices of chemical products. In certain other instances the changing cost of chemical equipment may also be an important consideration. To show the relations between these various changes, the accompanying plot gives price indexes for labor, products and equipment in



Price indexes for chemical industry labor, equipment and products show why marginal processes are being squeezed between high cost and low return.

the chemical industries for the period 1941 to 1948. The chemical prices cited are from Chemical Engineering's Chemical Price Index, the wages from the Bureau of Labor Statistics' data for Chemical and Allied Industries, and the equipment costs from the Marshall and Stevens Indexes of Comparative Equipment Costs. For convenience all have been reduced to a base of 1941 = 100. In this plot discontinuities in the rates of increase reflect the war-

time governmental regulations.

To test the effect of these price trends conselling sider as a typical example the manufacturer who buys raw materials at chemical index prices, adds a certain amount of processing and then sells the semi-finished materials on a market which has undergone the same price fluctuation as the raw materials. The changing cost of labor has greatly exceeded the changing selling price of chemicals and the differential is reflected by reduced profits. The greater the per-centage of labor in the total manufacturing cost, the greater is the effect of the differential changes on the operating economy. There are two ways in which these changes affect the chemical manufacturer: first, in the operation of an old process and secondly in planning a new one.

**Profits** 

Cost vs

With regard to the operation of old processes, are compare the profitability of continuing to operate an average process today which was designed in 1941. For a breakdown of operating costs as a function of net sales, the results of a broad survey\* are available covering the analysis of 366 chemical corporations through their profit and loss statements and data obtained from the FTC and SEC. The average profit and loss statements for 1941 and 1947 are given in Table I together with a breakdown in percentages. Data for 1948 are not sufficiently complete at the present time to permit their

inclusion but they may be estimated with sufficient accuracy for present requirements. 1941 labor accounted for 12.6 percent of the total sales breakdown and the gross profit was 16.4 percent. In 1947 labor and materials had risen, although sales expenses were lower and gross profits declined to 11.2 percent.

The figures in the averages of Table I do Large not correspond too closely with those which might be expected from the indexes in Fig. 1. For example, the labor cost in the average shows an increase between 1941 and 1947 of only  $15.8 \times 100/12.6 = 25$  percent, whereas the labor index rose 671 percent in 1947 and 871 percent in 1948. But at least part of the discrepancy can be traced to its origin. The data of Table I represent a large number of companies and are undoubtedly dominated by the dollar volume of the operators of the large continuous processes who were operating many of the same installations in 1947 as in 1941 but with higher annual output during 1947. Although they paid the same basic hourly labor rate, their ability to increase continuous proceses to full capacity without a proportionate increase in the number of labor hours has reduced the average labor cost below the value indicated in the index.

To see how the smaller processes have faired What of in the face of the changing indexes, consider the case of a batch operation having labor requirements proportional to the total hours of operation at full capacity. This also includes the premise that batches be run only when the demand is sufficient to warrant operation at full

During the period from 1941 to 1948 the chemical price index rose only 29 percent. If the same quantity of the same materials were sold by the manufacturer as in 1941 it would have resulted in gross 1947 sales of \$2,040,000 as shown in Table II, as against \$1,581,000 in 1941. Under the premises above, if other manufacturing and sales costs had been kept in the same proportion as in 1947 (the last year for

Table I-Averages of Survey of 366 Chemical Com-

|                                       | panies      |          |             |           |
|---------------------------------------|-------------|----------|-------------|-----------|
|                                       | 1941        |          | 1947        |           |
| Net sales                             | \$1,581,000 |          | \$2,354,000 |           |
| Material                              | 727,000     | (45.017) | 1,183,000   | (49.0°(.) |
| Labor<br>Fixed charges and other mig. |             | (12,6%)  | 373,000     | (15.80)   |
| charges                               |             | (7.1%)   | 186,000     | (7.9%)    |
| Total manufacturing costs             | \$1,038,000 | (65.6%)  | \$1.712,000 | (72.7%)   |
| Sales and administration              | 284,000     | (18.0°;) | 378,000     | (16.1%)   |
| Gross profit                          | 259,000     | (16.4%)  | 264,000     | (11.20%)  |
| Total                                 | \$1,561,000 |          | \$2,354,000 |           |

Table II-Extrapolation of 1941 Data to 1948

|   | 1948                |
|---|---------------------|
| Net sales   | \$2,040,000         |
| Coets   |                     |
| Material, \$727,000 × 1.29                                | 937,000 (45.9%)     |
| Labor, \$199,800 × 1.875.<br>Fixed charges and other mig. |                     |
| charges   | 161,000 (7.9°c)     |
| Total manufacturing costs                                 | \$1,472,000 (72.1%) |
| Sales and administration                                  | 325,060 (16.15)1    |
| Gross profit  |                     |
| Total   | \$2,040,000         |

<sup>·</sup> Unpublished survey courtesy of R. S. Aries and

### Table III-Effect of Price Trends on a Typical Batch Process

|  | 1941        |                      | 1945               |                   |
|--|-------------|----------------------|--------------------|-------------------|
| Not sales  | \$1,581,000 |                      | \$2,040,000        |                   |
| Material<br>Labor.<br>Fixed charges and other mig. | \$19,000    | (23.8%)              | 327,000<br>974,000 |                   |
| charges  |             | $(\overline{x},1\%)$ | 161,000            | (7.9%)            |
| Total manufacturing costs                          | \$1,038,000 | 65.61,1              | \$1,662,000        | (8L4%)            |
| Sales and administration<br>Gross profit           |             | (18.0%)<br>(16.4%)   | 328,000<br>50,000  | (16.1%)<br>(2.5%) |
| Total  | \$1,581,000 |                      | \$2,040,000        |                   |

which figures are available), the material cost, percentagewise, in 1948 would be the same, but labor would have risen from 12.6 to 18.3 percent, while profits would have declined from 16.4 to 11.8 percent. Note that in 1941 the averages of the chemical industry show that labor represented only  $12.6 \times 100/65.5 = 19.2$ percent of the total manufacturing costs for all processors while in some batch processes labor may represent as much as 50 percent or more of the total manufacturing cost.

**Profits** 

rero

approach

Referring to Table III, for a batch process in which labor was 50 percent of the total manufacturing cost in 1941, and using the same ratios as in 1947 for the other costs, gross profits would have declined to 21 percent. The continuation of an operation with so small a gross profit may lead to a deficit after taxes are deducted. If the batch process is operated by a large processor who also operates continuous processes, the deficit on the batch process is apt to be even greater. And if a processor has increased capacity since 1941 by adding successive batch installations similar to those in operation in 1941, the influence of the changing trends is considerably amplified.

What does this mean in terms of present day Should the equipment of plant operation? several smaller operations be abandoned entirely in favor of a larger process requiring new capital There appears to be little favorable support for such a move at the present time since the abandonment of equipment represents a decline in company net worth. The recapitalization of a process may not be feasible either, since it is based on the return in terms of company net worth, and the cost of chemical equipment has risen almost as sharply as labor. Another alternative is the discontinuation of a small process altogether, but this too requires careful consideration. To the small operator the discontinuation of a process may be equivalent to a partial suspension of business and loss of good will. The large operator, on the other hand, can scarcely benefit from discontinuing a small process unless other costs can be dropped proportionately to offset the reduced sales of Processes providing accommodathe company. tion and specialty products which do not follow the chemical index are naturally excepted.

As already hinted, there is a solution to the problem which deserves far greater acceptance than present activity indicates. Since the most important trend factor in profitable operation has been the percentage of labor entering into manufacturing costs, it is this labor percentage that must be improved. It is possible

to reduce the labor requirements by transforming small processes one step higher in "continuas from batch to semi-continuous, or from semi-continuous to continuous operation. In continuous processes the percentage of labor can be reduced by increasing the operating capacity of an existing continuous process. By these means an opportunity presents itself for overcoming the unfavorable influence of the indexes. If only a portion of the equipment need be replaced in effecting the transformation, it is highly probable that the increased fixed charges will be offset by reductions in the cost of

In May 1945 Chemical Engineering published No simple the results of an extensive survey on process-This report summarized the controlling processing factors entering into the solution of a manufacturing problem through the use of a hatch, semi-continuous or continuous process, The findings emphasized that any conclusion resulting in the selection of a batch, semi-continuous or continuous process hinges upon a large number of variables-of which the important ones are discussed below-and cannot be determined by a simple formula.

As the foregoing analysis has shown, an addi- But costs tional factor has since come into importance. This is the influence of the primary cost trends -labor, chemicals and chemical equipmenton the selection of the most favorable type of process. Although the data are not as complete as desirable, it has been demonstrated that a process selected on a sound basis in 1945 or before may be operating today at a loss. The loss is usually greater for small capacity processes, whether operated by large or small manufacturers. In fact, the larger manufacturer who operates several small processes without close accounting on each of them may find his profits severely drained by these small losing process units. Because their cost is obscured by over-all operations they may pass from credits to debits without attracting attention unless subjected to accurate accounting controls.

For many years it was felt that continuous More processing was adaptable only to the larger operations, and batch processing to the smaller. These generalizations were and are substantially today correct although they shed no light on the economic dividing point between large and small processes. Since the costs of chemical labor and equipment have risen so much more rapidly than chemical selling prices, generalizations on size can no longer be used to define the range in which continuous and particularly semi-continuous processes are applicable. Today the roster of continuous and semi-continuous processes includes numerous manufacturing operations which only a few years ago were invariably

set up as batch operations. Unfortunately, comparison between the dif-

ferent methods of processing cannot always be reduced to an identical basis. The products of alternative batch and continuous processes are not always the same and some of these differences may preclude all of the general factors from further consideration. The product of a continuous process remains relatively uniform with time if the feed stock remains uniform.

influence decision

Solutions can be reached

In batch distillation the initial overhead product contains a greater proportion of the volatile components than the product coming off later in the same run. As in certain cases of animal and vegetable oil refining, the overhead fronts may command a premium market price. Continuous distillation, on the other hand, does not afford an initial product of comparable premium grade since the overhead product is uniform. The premium grade may be attained, however, if a considerably greater sum is spent on utilities and claborate apparatus. When the product is the bottoms of a distillation rather than the overhead, the emphasis is placed on the final rather than the initial stages of the operation. If the bottoms product shows instability as the still temperature increases, the advantage of the brief hold-up in a continuous operation is ap-

Copocity favored by continuity

It is well known that in most processes the carrying capacity of continuous equipment per dollar of investment exceeds that of batch equipment. For example, a batch treating vessel having a retention of 5,000 gal. per hourly batch—which is nearly the size limit for nonatmospheric batch processes-is replaceable by a continuous apparatus having a flow area equivalent to a 3 in. IPS pipe. In fact, one sharp distinction occurs between processes which will ultimately be scaled up to 5,000 gal. per batch, and those which might require even larger batches to provide the desired daily capacity. Also, when planning the capacity of a projected process the anticipation of a 100 percent future expansion can be incorporated into the original design of a continuous process at an increased cost of only about 25 to 40 percent. In batch processes, however, an expansion of 100 percent may entail an almost proportionate increase in cost although the decision to add capacity may often be made only as required.

Weighty

Furthermore, larger continuous plants may factors be operated without increased labor, although almost proportionate man hours must be added for batch expansion. Others factors, too, have considerable weight in selecting the type of process, such as the versatility of the equipment and annual hours of use, the requirement of curing or reaction time or other hold-up exceeding about 15 min., the continuous availability of raw materials, and the volume and continuous demand for the product. Still other influencing factors are: the quantity of product susceptible to spoilage, the cost of going on and off stream, comparative problems of control, storage, fractional capacity range, quality differentials inherent in the type of process, utility peak loads. wages and labor overtime, etc.

Revamping

The possibilities for revamping processes economical are innumerable. Much batch equipment can be reused because it is oversized by comparison with equipment required for the next upward step in process gradation. When a process is revamped to make it continuous, it is often found that only 10 or 20 percent of all of the equipment represents a bottleneck to increased capacity. By replacing only the bottlenecks the capacity may be increased by as much as 25 or 50 percent with a small outlay.

By reason of crection, an erected piece of equipment is a more valuable commodity than the equipment uninstalled, exceeding the fabricated equipment cost by 25 percent or more, depending on size, and whether field or shop fabricated. Considerable revamping may be engineered without dismantling erected equip-

Revamp engineering usually falls into two Copocity main classes: (1) changes in capacity and (2) changes in function. With respect to the former, the component pieces of equipment on well designed processes generally contain a liberal factor of overcapacity. This is also true of the utilities and utility lines such as steam, water and power. When the capacity of an existing process is to be increased, the ultimate capacity can best be determined by extrapolating

test runs at partial capacities.

This is particularly true for distillation and absorption equipment where additional capacity may be obtained by changing caps and weirs alone. The ultimate capacities of heat transfer equipment can be determined either from experiment or by calculation. Pumping capacity is rarely a bottleneck although it is the simplest factor to correct, since pumps usually represent less than 5 percent of the total value of average installations. Deficiencies in the carrying capacities of interconnecting lines and fittings are also corrected readily by substituting a pump having not only increased capacity, but also increased head. Qualitative instrumentation and control requires only a minor modification of the original instruments, although somewhat larger changes are usually required on volumetric measurement and control apparatus.

A typical analysis of revamp jobs on commer- Double cial distillation assemblies shows that capacities in representative units can be increased by 25 20 percent percent at a cost of only 5 to 10 percent of the original erected cost of the installation. Capacity increases as great as 100 percent can be obtained by altering internal designs while the original equipment remains in place. The cost of a 100 percent capacity increase usually will not run more than 15 to 20 percent of the original erected cost of the installation. In a large number of instances the required changes in capacity can be effected simply by supplement-

ing existing heat transfer equipment.

When changes in process function are under- Vital taken it is possible to effect even greater econ- engineering omies. For example, an absorber-stripper re- service covery system can be converted into a precise fractionation assembly for as little as 5 to 10 percent of the erected cost of new equipment. Naturally the laws applicable to revamping are more complex than those applicable to straightforward process design. Many factors which are ordinarily design variables are fixed during revamping by the existence of some or all of the equipment to be used. For this reason revamp engineering requires even greater experience than process design, but experience in design is the principal requisite for effective revamping. Hence we must conclude that revamping must now be elevated to the status of a vital engineering service, rather than be regarded as the stepchild of plant maintenance.

functions

# COST CUTTING CHECK SHEET FOR

### E. S. COLDWELL, President

Ford, Bacon & Davis, Inc., New York, N. Y.

American industries — process industries included — are in a period when profit ratios have been seriously reduced. Costs have gone up more rapidly than selling prices. Break-even percentages have increased — sometimes sharply — and good earnings today hang precariously on the maintenance of high volume.

Management is now faced with a double-barrelled problem: How to reduce unit costs and, at the same time, to increase productivity, industry must batten down against the chance of rough weather ahead. It must be prepared for the possibility that prices and sales may decrease rapidly while wages may fall slowly, if at all.

This is not to predict that a serious recession is ahead. It is rather a case of insurance bought, not in expectation of fire, but as protection if the unexpected occurs. Once unit costs have been trimmed and productivity improved, a company is doubly insured — not against recession alone but also against the keener competition that is certainly ahead.

Close and critical scrutiny of every element that enters into the over-all cost of doing business is the essential ingredient in any cost reduction program. What are the steps in such a scrutiny? Every progressive management will recognize them. Still, such a stock-taking can be arduous, particularly in view of the well known difficulty of seeing the forest for the trees.

Aware of the harassed executive confronted with today's mounting problems, we consider it appropriate to offer a list of factors which are applicable to most organizations. It is to help in organizing a realistic effort and to avoid overlooking some obscure, or possibly too obvious, point that this cost cutting check sheet has been prepared.

|   |   | Now Bei | New Stud | Froblem |
|---|---|---------|----------|---------|
| 1 | BROAD POLICIES  | -       |          |         |
| 1 | Have primary aims and objectives been reviewed recently?.  Elementary as it may seem, companies sometimes lose sight of primary aims and long-range objectives. Review promotes thinking. It helps to settle such questions as; how to operate in case of a general drop in business activities; whether to go into supplementary and related lines; whether to plan for expansion or contraction; whether to decentralize or to integrate existing facilities. |         |          |         |
| 2 | Should outside viewpoints be sought on over-all cost reduction problems?  |         |          |         |
| 3 | Has decentralization been considered?  Shifts in market or in raw materials supplies; better labor reservoirs; more favorable freight situations; delineation of responsibilities, may point to decentralization.   |         |          |         |
| C | COMPANY ORGANIZATION  | _       | _        | _       |
| 1 | Does the company organizational set-up fit today's problems?  |         |          |         |
| 2 | Is the present departmental setup best for present needs?   |         |          |         |
| 3 | Have job definitions been clearly established?  |         |          |         |
| 4 | . Can personnel policies be improved?  If unit costs are high and productivity is low, personnel policies may be at fault-morale and loyalty may be lacking and labor turnover may be excessive.  |         |          |         |
| М | ANAGEMENT CONTROLS AND RECORDS  |         |          |         |
| 1 | Have company records as a whole been closely scrutinized?  Those relating to activities, costs and results should be specially analyzed to reveal trends, weak spots, high cost products, substandard performance in certain departments.   |         |          |         |
| 2 | Are sales forecasts and production schedules based on adequate and accurate information?  |         |          |         |
| 3 | Are sales and production planning closely coordinated?  |         |          |         |
| 4 | is inventory control realistic and effective?   |         |          |         |
| 5 | Do company reports on which management decisions are based accomplish the job intended?   |         |          |         |

# CHEMICAL PROCESS INDUSTRIES

|    |   | Now Bein<br>Studied | New Study<br>Required | Not a |
|----|---|---------------------|-----------------------|-------|
| H  | ARKETS AND PRODUCTS   |                     |                       |       |
| 1  | I have present products been subjected recently to effective market research? Market research can furnish profitable information: sales potentials; new consumer trends that may call for changes or new attitudes; geographical shifts in markets; competitors' practices; company's position in competitive market. It may indicate whether pricing policies and trade methods are faulty; whether certain products are "weak sisters;" whether others have cyclic or seasonal demands. |                     | П                     |       |
| 2  | Is product research being devoted both to present products and to potential new ones?   |                     |                       |       |
| 3  | Does process research have an important place in the research budget?   |                     |                       |       |
| F  | PRICING, PROMOTION, SELLING AND DISTRIBUTION  |                     |                       |       |
| 1  | Are products priced correctly for the market?  Pricing requires close study of break-even points. These have risen because price-volume-profit relations have been upset by changes in the ingredients. Today a price cut may not increase volume sufficiently to produce an equal or greater profit. Conversely, although price increases are now generally frowned upon, an increase may not cut volume proportionately.  |                     |                       |       |
| 2. | Can break-even points be lowered by technological improvements or better management controls?  Direct and indirect costs can be affected by a search for technological improvements, indirect costs can be controlled by management. Variable costs do not necessarily change directly with volume, and "fixed" costs can sometimes be "unfixed."   |                     |                       |       |
| 3. | Are promotion costs and selling expenses in line with results?  |                     |                       |       |
| 4. | Are packaging and distribution costs as low as possible, consistent with other requirements?  Packages sell consumer products in most industries. However, in bulk process industries, improved economy in packaging and in distribution can yield handsome dividends.  |                     |                       |       |
| 51 | UPPLY PROBLEMS  |                     |                       |       |
| 1. | Can supply sources be improved?  Present raw material sources may be playing out or additional processing may be needed to overcome poor quality. Perhaps alternate raw materials will reduce costs, improve the product, or make supply more dependable.   | П                   |                       |       |
| 2. | Should raw materials be produced or purchased?  |                     |                       |       |
| P  | RODUCTION AND HANDLING  |                     |                       |       |
| 1. | Should improved processes, perhaps continuous rather than batch, be sought?   | П                   |                       | П     |
| 2. | Can use of utilities be made more economical?   |                     |                       |       |
| 3. | Do production bottlenecks prevent an economical expansion of output?  |                     |                       |       |
| 4. | Can materials handling be improved?   |                     |                       |       |
|    | This list does not attempt to cover the entire scope of cost reduction. It may, however, open fresh channels of thought, encompassing special problems of the reader's own organization.  |                     |                       |       |

CHEMICAL ENGINEERING-October 1949

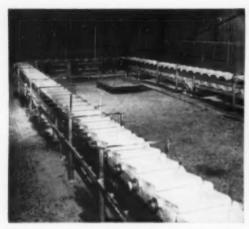


Fig. 1-The runaround "Side-Kar Carrier" is especially suited to fragile materials such as minute hollow spheres,

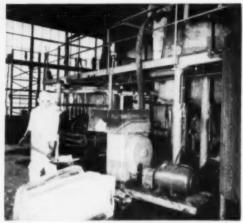


Fig. 2-Portable ice crusher-slinger simplified materials handling and improved crystallization of a chemical product.



Fig. 3-For one-way drum movement along a wharf the platter conveyor does the job at lower cost than industrial trucks.

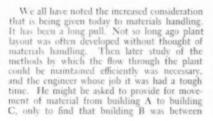


Fig. 4-Sometimes a platform conveyor is the answer in the handling of miscellaneous loads, but the case is borderline.

# Wages Up, Costs Down With Better Materials Handling

Better grade labor today realizes that improved materials handling means savings leading to higher wages

WILBUR G. HUDSON, Consulting Engineer, Chicago, III.



the two, forcing him to go over, under, or around

Today it is not unusual for the plant to be laid Planning out around the material handling scheme. Prob- from the ably full realization of the importance and possi-stort bilities of mechanical handling in cost reduction came when we got into the full swing of wartime production. The volumes and quantities involved were fantastic and speed became paramount. The improvements adopted have had a marked influence on methods subsequently used. One illustration is the today's widespread



employment of motorized industrial trucks, which frequently show savings as high as 90 percent as compared with earlier manual handling methods.

Savina

Gadaets

production

speed

It is appreciated that if mechanized handling will enable a given capital investment to increase output volume, then both fixed charges and profits will improve-but there are other factors. The New York Department of Labor, in Bulletin 181, mentions that 23,735 material handling accidents were compensated in a single year in New York State, at a cost of \$5,009,000. "In the whole field of industry," says the report, "there is no place where safety and efficiency are so intimately associated. The same effort which makes the handling of goods less costly also makes it safer.

Another factor is the growing realization by labor, unless misguided by short-sighted or subversive leadership, that improved methods pay off. The young man of average intelligence and a normal degree of ambition appreciates that educational opportunities can lift him from the "common labor" class to the semi-skilled level, commanding twice the pay. Under favorable conditions, he knows, he can go on to the skilled labor level with unlimited possibilities. The need for common labor in a country like ours tends to decrease relatively, while the demand for men with specialized skills increases.

Along with education and training comes a better appreciation of devices or methods which increase output with decreased effort. fact impressed a group of British industrial leaders here on a recent tour of American plants. One commented, "People in the United States are so gadget minded they won't work long at a job without trying to rig up a gadget to speed up the job or do part of it for them. That is why the American worker produces more than most British plant workers, without exerting any more effort.

Notwithstanding an appreciation of what mechanical handling can accomplish in cost reduction executives must, of course, be shown how long it will take for the installation to pay for itself. Only then can an expenditure of thousands of dollars be approved. This is not always easy to demonstrate. Naturally, the conveyor manufacturer cannot be expected to guarantee savings -for one reason, he has no control after his

equipment is installed.

I recall one offer to install the equipment both covered by a rejected bid without charge, and ways maintain it for ten years. The consideration was a 50-50 split of the savings in handling costs. Such a proposition has possibilities both ways. though somewhat risky for the contractor. The manufacturer of motorized trucks has an advantage here. He will send one of his machines and lend a trained operator to prove, through actual demonstration, the results that can reasonably be expected. The reaction of the men is uniformly helpful. That gadget-mindedness on which the Englishman commented does seem to exist. Perhaps it is just a sense of pride inspired by a smoothly functioning plant in those working there.

Not infrequently there are circumstances where improvements in mechanical handling not

only reduce operating costs but substantially improve the functioning of the processing equipment. During the war considerable difficulty was encountered in making metallic magnesium from flake magnesium chloride. material must be fed continuously to a battery of electrolytic cells. The operation calls for a horizontal runaround conveyor, operating con-tinuously. If the magnesium chloride is ground up, the cells will not function and must be shut down and cleaned out. This happened frequently when the material was pushed by a scraper conveyor, causing much lost time.

A runaround carrier was devised which handled the material with practically no degradation and eliminated shut-down of the equipment. This machine (Fig. 1) consists of a train of rectangular buckets attached to a roller chain on the inner side, with automatically operated drop-bottom gates. Surplus material remains in the buckets and is re-circulated until a new

discharge point is crossed.

Subsequently this carrier has found a place Hondling in the chemical industry. For example, Fig. 1 shows a West Coast installation for handling fragile pellets, or thin-shelled spheres, weighing about 10 lb. per cu. ft. The material is delivered to a line of storage bins, and must be handled without degradation. Known as the "Side-Kar Carrier," it has worked out nicely. The installation has a rectangular path 70 ft. long by 12 ft. between runs, and is driven by a 1 hp. motor at 16 ft. per min., handling up to 700 cfh.

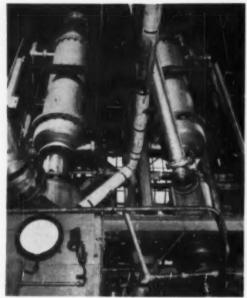
A clever handling re-arrangement which sub-stantially improved the product at small invest-does it ment cost occurred in a Chicago chemical plant. better Originally ice cakes were hoisted to a charging platform where an operator broke them up and shovelled these rather large chunks into a tank. Here a solution was agitated and chilled for crystallation. The relatively small total surface area of the ice chunks not only caused undesirably large crystals, but brought about the occlusion of solvent in the crystals. Six cakes of ice-about 2,400 lb.-were used per charge. The solution entered the vessel at about 100 deg. C. Obviously if the ice could be used in finely ground condition, the efficiency of the operation could be improved.

A simple ice-slinger was installed. This device pulverizes and sprays snow-ice into the tank. The greater surface area of the finely crushed ice provides not only much quicker cooling but gives control of the crystal size. Being conveniently portable, the ice crusher-slinger unit can be pushed from one vessel to another as

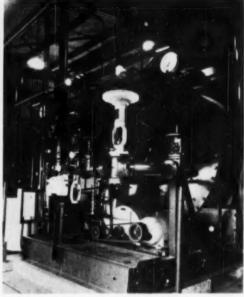
required, as Fig. 2 suggests.

Returning to the motorized industrial truck Truck and its applications, its use is now generally ac-versus cepted for handling packaged or palletized loads from cars, through the plant, to storage, and to cars for shipment. However, since the efficiency of its performance and the maintenance costs and damage to buildings, sprinkler pipes, merchandise, etc., are all dependent directly on the skill of the available personnel, this device has by no means rendered the conveyor obsolete. A conveyor may offer the better solution of a given problem.

(Continued on page 106)



Heat exchangers are typical of equipment cleaned by acidizing, with greatly improved heat transfer.



Boiler scale is often removed efficiently with acid and proper additives. Gas fire boilers are pictured.

## Acidizing Cuts Cost of Cleaning **Process Equipment**

Here in a two-part article is information on the actual savings from acidizing, and on cleaning techniques



#### ROGER WILLIAMS, Jr,. Assistant Editor, Chemical Engineering

Cutting maintenance costs by cleaning equipment with acid is not new. Chemical Engineering first discussed it in 1927 (July, p. 423). Companies have been actively doing such work since 1932. But relatively little has been written about the economics of acidizing.

The early use of hydrochloric acid, inhibited to prevent attack on steel, was in acidizing oil and gas wells. Where productive zones were located in limestone formations, injection of acid into the well would increase the size of the bottom hole. Since oil and gas production rates depend on area, the greater the hole size the greater the production.

As the use of acidizing grew, the companies doing the work naturally looked for other uses for inhibited acids. A ready market appeared to be cleaning boilers, removing the residual solids left in boiler tubes by the evaporating water. Many a chemical company has been using this

The big place that acidizing fits into chemical processing is in cleaning piping systems, heat exchangers, towers and other equipment that gets 'gunked up' every so often. Here, acid dissolves the 'gunk' without having to dismantle the equipment. Chemical cleaning is not only cheaper, but it also means a shorter shut-down time. That can mean two things: lower maintenance costs and the possibility that spare equipment may not be needed.

The way acidizing is handled is pretty simple. Fasily Most companies doing such work have trucks occom that bring the acid to your plant. More than plished that, they have pumps mounted on their trucks. All they need are suitable piping connections to get the acid into the unit, a supply of steam and water, and, of course, a sewer. Acidizing operators usually haul in concentrated, inhibited hydrochloric acid. They dilute it as they put it into the equipment and heat it at the same time.

In most cases, chemical companies employ acidizing companies to do the work. Such companies have the trucks, the know-how, and do a good and inexpensive job. A few of the larger companies do their own work,

The figures in the accompanying table were supplied to this magazine by a major chemical company with the request that the company

Acid's

early

0110

#### Acid vs. Mechanical Cleaning

| Equipment   | Method             | Shut-down<br>Time Req'd    | Approx. Con               |
|---|--------------------|----------------------------|---------------------------|
| Heat Exchangers<br>(2), each with<br>225 steel tubes<br>1 in. O.D. × 20<br>ft. long | Acid<br>Mechanical | 24 hr.<br>4-14 days        | \$350<br>\$800-2,000      |
| Condenser of<br>York absorption<br>refrigeration<br>unit                            | Acid<br>Mechanical | 8 hr.<br>48 hr.<br>minimum | \$275<br>\$400-1,000      |
| 4 × 40 ft. gas<br>scrubber with<br>metal rings                                      | Acid<br>Mechanical | None<br>12 hr.<br>minimum  | \$450<br>\$750<br>minimum |
| Shell and tube  | Acid<br>Mechanical | 24 hr.<br>48 hr.           | \$375<br>\$1,275          |

remain anonymous. In support of chemical cleaning, the figures speak for themselves.

On the types of equipment tabulated, acid cleaning has proved definitely superior to cleaning by mechanical means. The quality of the cleaning is better, outage time and cleaning costs are greatly reduced, some equipment can be cleaned without removing it from service, and some equipment can be effectively cleaned which cannot be cleaned satisfactorily any other way.

The heat exchangers mentioned in the table are used to transfer heat from a process gas to water passing through the tubes. The heated water is then used along with steam at 450 psi. to humidify a process gas. The amount of 450 psi, steam required is inversely proportional to the heat transfer in the exchangers.

The effectiveness of one cleaning of the water side of the exchangers by acid washing is shown by a reduction in the consumption of 450 psi. steam from an average of 81 lb. per M cu. ft. of gas to 61 lb. per M cu. ft.

Acid cleaning the water side of the condenser increased the production of the unit from 280 tons of refrigeration per day to 350 tons per day.

The scrubber is used for scrubbing traces of ammonia from CO gas at slightly above atmospheric pressure. Cleaning by acid washing is done with no interruption of production. Gas

pressure drop was reduced in one instance from 56 in. to 12 in. of water and ammonia carryover eliminated entirely.

The cooler has ammonia at 45 psi. on the shell side and is used to cool scrubbing water at 450 psi. passing through the tubes. The heat transfer coefficient was increased by acid cleaning of the water side from 60 to 170 Btu./(sq. ft.) (hr.) (deg. F.).

A large oil refinery has found acid cleaning Relinery of their boilers to be cheaper than turbining them. It required 1,700 man-hr. at \$1.50 per hr. to turbine a boiler, whereas acid cleaning cost only \$1,400. Acid cleaning increased steam production of a boiler in another plant from

598 lb. of steam per M cu. ft. of gas to 629 lb. Elsewhere, gasoline stock ran 20 deg. cooler through the 15 condensers cleaned with acid than it had been when mechanical methods were used. Based on vapor losses at the 20 deg. higher temperature, the chemical cleaning job would take only 124 days to pay for itself.

Two water filters, back-wash distribution system, and 8 in, feed line were chemically cleaned in 8 hr. at a total cost of \$750. No dismanteling of equipment and no disturbing of sand or gravel beds was necessary. Usual mechanical cleaning took 8 days for removal and replacement of sand and gravel beds while no method was available for cleaning the backwash system. The cost of materials involved in the mechanical method far exceeded the cost of chemical cleaning. No cost estimate was made for downtime.

In another plant two absorption towers and their preheaters were cleaned by first treating with a hot 5 percent alkaline solution and then with a 7 percent acid solvent. After the acid treatment, the equipment was washed and a final 1 percent alkaline wash given it. Total cost of cleaning was \$800 and downtime came to only 10 hr. as compared with \$1,200 and 4 days downtime for mechanical cleaning. From operational data chemical cleaning proved far superior.

#### LEO A. STOUFFER, General Manager, Vandergrift Industrial Acidizing Co, Charleston, W. Va.

Chemical cleaning of many deposits in process equipment is meeting with continuously wider acceptance in the chemical industry because of lower costs and greater convenience as contrasted with mechanical cleaning.

What equipment?

better

steam

saving

Equipment often cleaned by chemical methods includes heat exchangers, condensers, scrubbers, absorption towers, stills, heaters, boilers, engines, compressor jackets, tanks, and pipes. Deposits encountered, which can be successfully removed by chemical methods, include scale or coatings consisting of carbonates, phosphates, oxides, sulphides, sulphates, silicates, or organic matter.

A sample of the deposit is taken and analyzed in order to determine the proper solvent. In over 90 percent of the applications where chemical cleaning has proved practical, the basic chemical solvent is HC1.

To this are added wetting agents for penetration of dense or oily deposits, and inhibitors which prevent appreciable attack on the surrounding metal. Intensifying agents such as fluorides are sometimes included when silicates are present.

Where sulphates are in the deposit, a 5 percent alkaline solution is first boiled in the equipment. Silicate scales have also been successfully removed in this manner. Sulphides require absorption in caustic of the hydrogen sulphide formed to eliminate the toxic hazard.

Solvents used for deposits containing organic matter are generally of an organic or alkaline nature. Emulsions of an alkali, kerosene or other solvent, and an emulsifying agent are sometimes used. Many cases are known where special oxidizing agents have proved successful in removing stubborn organic deposits.

The variables in chemical cleaning are the strength of solution, the retention time, and the temperature. The HC1 solutions used are generally between 5 and 10 percent, although solutions up to 15 percent have been used to clean badly corroded pipelines and solutions as low as 2 percent are not uncommon. The

What variables?



Such truck tanks are used for acid cleaning. Here the operator is checking acid strength.

retention time depends on the solubility and thickness of the deposit. The temperature depends upon the solubility of the deposit and the effectiveness of the inhibitors at elevated temperatures. Inhibitors now in use are generally considered good for a maximum of 120 deg. F. with cast iron and up to 160 deg. F. with bronze, brass, steel, and Monel. Conservative practice dictates the use of temperatures below these maximums. HCl cannot be successfully inhibited for use in cleaning aluminum, zinc, or other light metal equipment.

Chemical cleaning is accomplished by soaking, short circulating, and spray methods. Large pieces of equipment such as boilers, large vertical heat exchangers, and tanks are usually cleaned by soaking. The normal time is 6 to 8 hr.

The circulating method is used whenever agitation is necessary such as in cleaning heat exchangers having very small tubes and engine jackets having parts difficult to vent. The solvent is pumped through the equipment to a sewer, or returned to the tank truck for reheating and strengthening, if necessary. Further agitation can be had by use of steam or compressed air.

Often

Time is

Quite often it is possible to clean equipment requiring cooling water without shutting down. shut-down In most cases it is necessary to run the equipment at less than full capacity, because it is not generally economical to circulate the solvent to the sewer at the same rate as cooling water would be circulated. It is in these cases that a very low concentration of solvent can be used. Equipment which has been kept in operation during cleaning includes engines, gas compressors, and blast furnaces. All types of scrubbers that use water as a scrubbing medium have been cleaned while operating under full load, the acid being used to replace the water.

The spraying method is used to clean open type box condensers.

It is important that in all types of chemical

cleaning, proper venting be provided for gases generated.

Although the basic principles of chemical Experience cleaning are simple, the difficulties encountered are sufficient to warrant a thorough study of the chemical and physical characteristics of the deposits encountered and a knowledge of the applicable inhibitors, wetting agents, and intensifiers before attempting a cleaning job. Knowing the strength of solvent to use, the retention time, and the temperature for a specific application comes largely from experience.

Wages Up, Costs Down

(continued from page 103)

Fig. 3 illustrates the job of moving oil drums along a long wharf, to and from barges. alternatives of a tractor handling trains of three or four trailers, or a reversible conveyor, make a valuable study. At the terminal points the costs will be about the same, but the movement between is handled better and at lower cost by a conveyor. If we assume a three-shift operation and a traffic of 75 drums per hour, we may specify one tractor, one spare, and 12 trailers of five drums capacity each (15 or 20 drums per train trip). This means an investment of about \$10,000. Operation will require three operators at \$10 per day each, and there will be a part-time charge for a maintenance man of \$3, or \$33 per 24-hr. day.

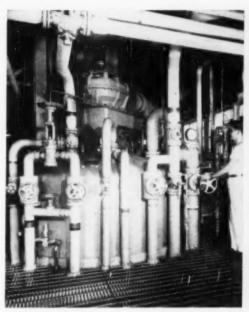
The conveyor with 15 hp. motor will cost Life about \$20,000 erected. Its power and mainte- offsets nance costs will be substantially lower, and about cost the only labor cost will be a part-time charge for the maintenance man, say \$3 per day. The investment is larger, but the life of the conveyor with ordinary replacement of worn parts should be at least 15 years.

If we introduce the further requirement that traffic must move in both directions simultaneously, the tractor-trailer method shapes up

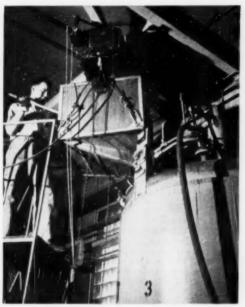
Fig. 4 illustrates a border-line case. There is a direct movement of miscellaneous freight to floor storage and back. A reversible apron conveyor with a light overhead power hoist may be provided to unload and reload the conveyor. Traffic is intermittent and in such a case a truck might function elsewhere when not needed for freight movement. That factor could well be the deciding point in favor of the truck.

This discussion of course has by no means Find the exhausted the matter of cost reductions that best are possible from improvements in the move- way ment of process materials. Nor has it tried to detail the various alternatives that the materials handling engineer is sure to face in each particular case. The idea that should be left, however, is that there are alternatives and that there is usually a best way from which the greatest savings and the maximum satisfaction on the part of the personnel can be attained.

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BIOLOGICAL PROCESS is typified by this 5,000-gal. Inconel-clad fermenter where mold growth makes Chloromycetin.



SYNTHETIC PROCESS uses conventional plant equipment such as this kettle for acetylation and hydroxymethylation.

## CHLOROMYCETIN BY PARKE, DAVIS

Parke, Davis has created an unprecedented situation in developing both a biological and a synthetic process for producing an antibiotic. Both are operating in the same plant

#### THEODORE R. OLIVE

Ever since the recognition of the value of penicillin some ten years ago, laboratories throughout the world have been actively pursuing the possibilities for synthesizing various of the presently known and proven antibiotics. Theoretically, at least, synthesis should have many advantages over biological methods because fernnentation processes are tricky and easily contami-

nated. But the antibiotics as a class are extremely complex compounds and none of the many attempts led to a practical commercial result until Parke, Davis & Co., at Detroit, developed a successful synthesis of Chloromycetin, its new antibiotic, during 1948.

The story of Chloromycetin is a long one in terms of achievement, if not in time. In space of only about two years the compound has been isolated, proved, synthesized, and put into production by both fermentation

and synthetic processes. We now have the unusual situation of witnessing a friendly contest between a biological and a synthetic process for the same material, operating in the same plant (although in different buildings) and producing a product which is identical in its properties, regardless of the method of manufacture. For the first time an opportunity is afforded to test whether the theoretical advantages of synthesizing an antibiotic are as great in fact as they appear to be on paper.

THEODORE R. OLIVE is associate editor of Chemical Engineering.

Before we go into the competing processes, we must look briefly at the antibiotics as a group, and particularly at the background and accomplishments of Chloromycetin. For, even though research may be able to untangle nature's antibiotic principles, at present it lacks sufficient information on the relations of structure and effect to discover antibiotics certainly without nature's help.

#### BACK TO THE SOIL

In the last two decades, since the classical work of Fleming in the late 1920's, it has become increasingly evident that the chemical byproducts of some of the lowly fungi have remarkable curative properties. Nearly every cubic inch of surface earth harbors tremendous numbers of organisms, including those resulting in the present known antibiotic chemicals, and doubtless many unknown ones as well. Hence it is not surprising that biologists and mycologists have been turning to the earth in their search for substances antagonistic to disease germs. Since the soil has presumably reached a state of equilibrium with respect to the many different kinds of organisms it contains, in all likelihood the earth itself is the most fertile source for the discovery of bacteriaantagonistic principles.

Several antibiotic substances have been isolated and studied within recent years, but the only ones known to be of commercial importance prior to November 1947 were penicillin and streptomycin. The third member of the trilogy, Chloromycetin, had already shown encouraging results in animal experimentation, but it was not until Dr. Eugene H. Pavne of Parke, Davis reached Bolivia late in 1947 that the full possibilities of this new antibiotic became evident. Having with him the world's entire supply—less than one-half pound—Dr. Payne gambled it all against a severe epidemic of typhus fever which was raging in the little Bolivian town of Puerto Acosta. The supply lasted only for the treatment of 22 patients. All made recoveries within a few days, and yet 28 percent died among the 50 untreated cases studied in the area.

The second test came in March 1948 when a team of Army medical workers took off with another pound of Chloromycetin for Kuala Lumpur, in Malaya. Here a closely related killer, scrub typhus, was playing havoc with the population, yet 100 percent recoveries was achieved in the 25 cases treated. Included among the patients were several with unrecognized typhoid, rather than scrub typhus, and they too recovered, but in a somewhat

longer time. Thus, it was discovered that the new antibiotic is effective also against this disease, for which an effective treatment had never before been available.

Another confirmation in still another field was obtained in the summer of 1948 in Baltimore where 17 patients suffering from Rocky Mountain spotted fever were freed of their fever in two days instead of the usual 17. Again, a disease which generally kills more than 20 percent of its victims was conquered with 100 percent effectiveness.

Chloromycetin was thus proven to be a weapon against a variety of organisms resistant to other known drugs and antibiotics. It is effective in cases of intestinal infections, notably typhoid fever; bacillary infections of the urogenital tract; and the fevers in which rickettsiae are causative. The latter are minute disease-causing parasites, intermediate between viruses and bacteria. Typhus, scrub typhus, and Rocky Mountain spotted fever are typical of the rickettsial diseases. In addition, Chloromycetin shows possibilities against undulant fever, primary atypical pneumonia, psittacosis, Q fever, lymphogranuloma venereum, several of the bacillary dysenteries, whooping cough, and possibly also against cholera and bubonic plague.

#### HOW IT STARTED

Chloromycetin's history started with a research grant made by Parke, Davis to Yale University. Dr. Paul R. Burkholder, in charge of the work, collected some 6,000 samples of soil from every corner of the earth and began the tedious task of isolating micro-organisms from the samples. In so doing he found more than 20,000 different molds, but of these only a limited number showed activity worthy of furnishments.

ther investigation. At the Parke, Davis research laboratories, Dr. John Ehrlich and his associates further studied the cultures and devised methods of growing them in quantity. Of all these, the culture later identified as Chloromycetin proved most promising for further effort.

The company assembled a team which was given the responsibility of determining the best method of growing the mold, of translating laboratory methods of isolation of the product into plant scale methods, and of studying the potentialities of the material. In a remarkably short time the major problems had been worked out, the chemical structure had been determined, and a decision had been made not only to produce it biologically, but to attempt its synthesis. Chemically the compound D-(-)-threo-1p-nitrophenyl-2-dichloroacetamido-1, 3propanediol (or chloramphenicol for short), Chloromycetin has the struc-

This compound not only has the property of being effective against an important class of diseases, but it is unique in being the first known product produced by a micro-organism that contains either a nitro group or a dichloracetic acid group. Although fairly complex, its structure suggested the possibility of synthesis, and a research chemical team went to work developing, first, one synthetic process, and then a second process as well. Pilot plant crews took over and evolved a successful commercial application of one of the processes, for which a fullscale plant is just now being completed.

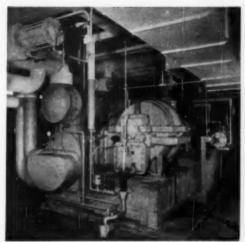
#### **Biological Process for Chloromycetin**

PICTURED FLOWSHEET PAGE 172

An interesting and outstanding feature of the H. K. Ferguson-built plant in which Chloromycetin is produced biologically is the fact of its great versatility. Work on the plant, designed for producing streptomycin, was started in 1945, with the idea that it should be capable with slight modification of producing penicillin or any other antibiotic which might later be desired. Late in 1948, when the plant was completed, the decision was made to use it for Chloromycetin rather than

streptomycin. However, with slight change, it can be converted to either penicillin or streptomycin, virtually without adding any additional equipment, simply by a minimum of repiping of existing equipment. In fact, not all the equipment which was installed initially for producing streptomycin is necessary in making Chloromycetin. The latter process is considerably simpler.

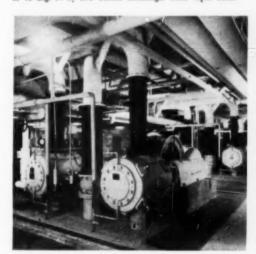
The plant occupies a ground space of 350 x 100 ft. and is partly two-story,



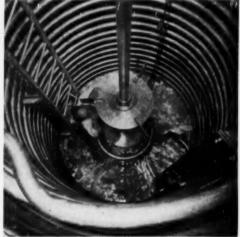
CHILLED WATER is provided to a closed cooling system at 48 deg. F. by two Carrier centrifugal water vapor units.



SOLID MATERIALS enter the process by being slurried with de-ionized water in this group of hooded hopper mixers.



AIR SUPPLY for mold growth is compressed to 35.40 psig. in these four Ingersoll-Rand duplex carbon-ring compressors.



FERMENTATION batches of the mold are aerated, agitated and cooled for 76 hr. in seven 5,000 gal. fermenters.

partly three-story, and partly four-story in height. Materials are received on a spur track and unloaded to a ground-floor receiving and preparation department where raw materials are stored and nutrient solutions and filter-aid slurries are prepared. All such storage and preparation take place in this department, which is isolated from the rest of the building to avoid any dust problem. The raw materials include the ingredients for the nutrient medium, which consists of wheat gluten,

glycerine, sodium carbonate, and sodium chloride. Other raw materials include diatomaceous filter aids, activated carbon, a penicillin-type defoamer, sulphuric acid, caustic soda and sodium bicarbonate for pH adjustment, and amyl acetate for extraction of the broth.

The other principal raw materials are water and air. The plant uses both city water and river water. The latter is used for cooling a closed chilled water system, with or without auxiliary refrigeration, depending on the season of the year. When the river water is not cold enough, the closed chilled water cooling system employs two Carrier centrifugal water-vapor refrigeration units. For process use city water is put through de-ionization units, and the de-ionized water is stored in aluminum tanks. Most of the cooling requirements are satisfied with 48-deg. F. water from the Carrier units. However, the plant employs some ammonia refrigeration, in which case the heat

transfer medium is a glycol-water brine. In addition, the laboratory employs distilled water for its own experimental

Durposes.

Air for the plant air-conditioning system, and also the intake air for the fermentation system, is cleaned by American Air Filter Airmat electrostatic filters. Air for the aerobic growth in the fermenters then goes to four Ingersoll-Rand carbon-ring reciprocating compressors, each a duplex machine with an after-cooler, carried on separate foundations to isolate vibration from the building. The air at 35 to 40 psig, flows to a group of steel receivers, then passes through stainless steel mesh and carbon sterilizing filters before entering the spargers of the fermenting tanks. The plant airconditioning system serves offices, laboratories, and some manufacturing departments.

The process may be considered as starting in the biological laboratory where cultures of the desired mold. Streptomyces venezuelae, one of the actinomyces family, are preserved and grown. The initial culture is kept in a dormant state in earth under refrigeration. From time to time agar "slants" in test tubes are seeded with the parent culture and grown under carefully controlled sterile conditions. To serve this function, as well as the numerous research and control activities conducted in the building, a special nutrient room is provided where culture media are prepared, as well as a special "kitchen" where all laboratory glassware is sterilized, then cleaned in a dish-washing machine and resterilized.

After the "slants" have reached the optimum stage of development, the culture is scraped out with a silver wire loop and is maintained in a dormant condition under refrigeration until needed, suspended in a castile soap solution. The soap solution suspensions are preserved in this department until called for by the manufacturing de-

partment.

#### IN THE PLANT

The plant process proper may be considered to start with the preparation of the nutrient medium. (For a Pictured Flowsheet, see p. 172.) The medium solids are weighed in the desired proportions into a 1,500-gal. aluminum preparation tank provided with an agitator. Here the nutrient is made up in concentrated form with deionized water, after which it is pumped as needed to a single 5,000gal, tank in the fermentation room which serves as the sterilizing tank for the seven seed tanks and seven fermenters. To follow through any particular batch, we start with the pre-seed

room in which there are seven 50-gal. Inconel tanks, each provided with a jacket for steam or chilled water, and an air sparger. A tank is charged with nutrient medium which is diluted to needed strength with de-ionized water, then sterilized at 252 deg. F. with steam on the jacket. Chilled water at 48 deg. F. then circulates through the jacket to cool the contents from sterilization temperature. Now the tank is ready for inoculation, which is accomplished in a sterile and ingenious manner. The culture medium grown in the biological department is brought to the pre-seed room in a sterilized syringe and is injected into the tank through a self-scaling rubber diaphragin by penetrating the diaphragin with the syringe needle. The culture grows under sterile air agitation and close temperature control at about 86 deg. F. Cooling water is supplied to the jacket under automatic control to maintain this temperature by withdrawing the heat of growth. A backpressure valve maintains air pressure at about 10 psig, to prevent possible in-leakage and contamination. The duration of growth in the pre-seed tank is optimum at about 24 hours. Then the contents of the tank is ready to be blown by sterile air into one of the seed tanks in the fermenter room.

The fermenter room contains eight 5,000-gal. vessels of 20 percent Inconelclad steel, equipped with Inconel fourblade agitators, baffles, and Inconel cooling coils. It also contains seven 500-gal, seed tanks which are of similar construction except for the use of jackets rather than coils. One of the eight 5,000-gal, tanks is used only for sterilizing the freshly prepared nutrient medium. Each batch in this tank consists of enough nutrient to charge one seed tank and one fermenter. Concentrated nutrient solution from the preparation tanks is run in, diluted with hot de-ionized water, and heated with live steam through a ring sparger to a sterilizing temperature of 252 deg. F. Chilled water is then run through the coils until the temperature is reduced to the fermentation temperature of about 82 deg. F. The charge is then transferred by sterile air pressure to one seed tank and also one of the fermenters. Both tanks have previously been manually cleaned and sterilized with live steam at 225 deg. F.

As soon as fermentation of one of the pre-seed charges has been completed, the tank contents is blown to one of the seed tanks already freshly charged with sterile medium. Cooling water is put on the seed tank jacket, the agitator is started, and the air bubbled through the sparger to raise the internal pressure, under control of a back-pressure vent valve, to about 10 psig. The temperature at the seed tanks is maintained at about 82 deg. F. for the entire period of growth of about 24 hours, which represents the optimum time for this operation.

When a seed tank charge has been propagated to the optimum point, it is blown with sterile air to one of the 5,000-gal. fermenters which has been freshly charged with sterile nutrient medium. Here, again, fermentation proceeds for an optimum period, which in this case is about 76 hours. Again, this requires cooling water on the coils, temperature control at about 82 deg F., and continual flow of sterile air, together with mechanical agitation When fermentation is completed the contents of the fermenter is discharged by air pressure to 3,000-gal. Inconellined tanks which serve as feed tanks for the filters. Here filter aid and decolorizing materials are added,

Before going on to describe the filtration, it is well to discuss a number of features of the fermentation operation. One of the tanks in the preparation room is used to store a deforming oil which is maintained hot, at sterilization temperature, and is circulated continuously by a pump through a loop line connected through automatic equipment to each of the fermenters. Each fermenter is provided with electrodes which detect the formation of foam. As soon as the foam level begins to rise, the anti-foam agent is automatically injected from the circulating line until the foam subsides.

As in the case of so much of the equipment, most of the process valving and piping in the plant is Inconel. In lines where contamination might take place, notably those associated with the pre-seed, seed and fermentation tanks, steam connections are provided so that steam flow can be maintained through all lines of this character when they are not otherwise in use. These same three steps in the fermentation process are all carefully instrumented with temperature and pressure controllers on each tank. In addition, the 5,000-gal, fermenters are provided with continuous pH recorders. Broth is continuously withdrawn from each fermenter by an Oliver diaphragm pump, circulated to a Leeds & Northrup pH electrode, and returned to the fermenter.

#### FILTRATION OPERATIONS

Each finished batch of broth from the fermenters must be filtered to separate the mycelia and produce a clear, polished broth containing the Chloromycetin. For this purpose two Oliver pressure-type rotary precoat filters are used. The filters are precoated with

a diatomaceous filter aid suspended in de-ionized water. Precoating is accomplished by a new automatic system. A thick slurry of filter aid is made up in the preparation room and pumped to one of two 100-gal. precoat tanks. The concentrated slurry is then mixed with de-ionized water, using a ratio flow controller employing venturis as the metering elements. The precoat filtrate (2) and precoat overflow from the filter tank, (3) in the flowsheet, p. 172, are dropped to the other of the two precoat tanks. A small amount of filter aid and decolorizing agent is added directly to the broth in the 3,000-gal. filter feed tanks and then the broth is pumped into the pressure filter (4). The cloudy filtrate (5) produced initially is returned to the feed tanks (8), as is the filter tank contents (7) at the end of a run. The clear filtrate (6) flows to two 3,000gal. holding tanks of 3S aluminum.

The two pressure filters are fabricated of Inconel and 20 percent Inconel-clad parts, and each has 50 sq.ft. of filtering surface on a drum 5 ft. 3 in. in diameter by 3 ft. wide. Each filter handles one batch, at the rate of 1,000 gph., employing a pressure of 20 psig. At the end of a filtering run, the remaining broth in the tank is drained and returned to the feed tanks, the cake is washed with de-ionized water, and then the cake is scraped from the drum and delivered by a screw to an inclosed Inconel-clad cake receiver. The contents of the receivers, consisting of spent filter aid and mycelia, is

#### COUNTERCURRENT EXTRACTION

discarded

Broth accumulated in the aluminum holding tanks can then be given a further polishing in an available 31-in. plate-and-frame filter press, although this has not proved necessary. The next step, therefore, is to pump the broth to the Podbielniak centrifugal countercurrent extractor, where the Chloromycetin is extracted in amyl acetate.

Contrary to practice in the penicillin industry, where three stages of counter-current extraction are commonly employed, only one stage is needed in the Chloromycetin process. It is also unnecessary to alter the pH sharply and the extraction problem is considerably simplified because Chloromycetin is much more stable than penicillin.

The Podbielniak extractor, developed by Dr. Walter J. Podbielniak of Chicago, is a machine which maintains contact between counter-flowing phases of two immiscible liquids, at the same time separating the phases by centrifugal force. It consists essentially of a drum containing a spiral of 33 turns

of stainless steel strip, supported at the sides to form a closed spiral passage 160 ft. long. The drum is mounted on hollow trunnions for rotation at any suitable speed up to about 2.500 rpm.

Seals at either end of the trunnions enable a heavier liquid to be introduced through suitable passages to the outer end of the spiral, being withdrawn at the center, while a lighter, immiscible liquid is introduced at the center and withdrawn at the outer end of the spiral. The liquid content of the rotor, introduced by pump pressure, is about 7 gal., and the throughput time only a few seconds. Control of the back pressure of the lighter liquid controls the relative volumes of the two liquids present in the rotor at any time.

As the liquids flow in opposite directions through the spiral, the heavier one seeks the outside, and the lighter the inside of the passage. At intervals mixing is accomplished by perforations through the wall of the spiral which permit some of the heavier phase to bubble through the lighter, after which centrifugal force produces separation. Depending on the application, it is claimed that one extractor may give the equivalent of five theoretical extraction stages or better.

In extracting Chloromycetin, the extractor is operated at 2,500 rpm. The broth is the heavy liquid, the amyl acetate the light. Both are introduced by pumps provided with bypass valves. Manual control is used, with flow rates adjusted from the visual indication of a rotameter in each feed line. A single Chloromycetin batch, including the wash water used on the filters, amounts to about 5,000 gal. For this purpose the extraction requires about 900 gal. of amyl acetate, so that approximately a 5 to 1 concentration is accomplished. Contrary to practice in extracting penicillin, it is unnecessary to use demulsifying and wetting agents in this step. The throughput rate for the extractor is about 360 gph, combined liquids, and the total time required for a single batch of broth, about 14 hr. At this rate, with a single extractor, it is possible to handle a maximum of about 10 batches per six-day week. With seven fermenters, this means a total active time of about 108 hr. per week per fermenter, which allows ample down time for cleaning.

The Chloromycetin-acetate concentrate from the extractor is collected in a 1,500-gal, tank of Type 316 stainless steel and then is concentrated further, to about 40 gal., in an Inconel natural-circulation evaporator operated under a 0.3-in. vacuum produced by a three-stage ejector. Operating temperature is less than 100 deg. F. This Buflovak evaporator is the type employing an external calandria and a separate flash chamber. The acetate collected in the stainless steel condenser is further cooled, decanted, and filtered through a Dollinger filter from which it is returned to two 1,000-gal. storage tanks for subsequent reuse.

#### PURIFYING AND CRYSTALLIZING

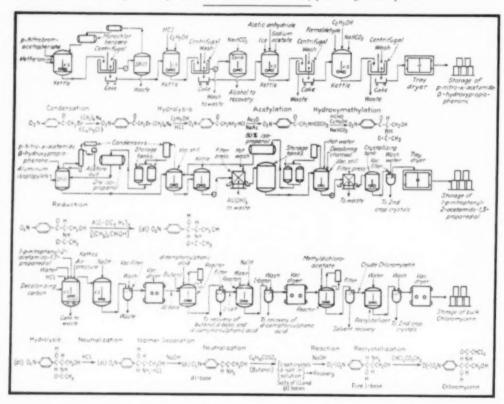
The concentrate from the vacuum evaporator, consisting of Chloromycetin dissolved in approximately 40 gal. of amyl acetate, is withdrawn from the evaporator at the end of the run to a small portable, wheeled vessel and transported to a 100-gal. tank equipped with a portable agitator. Here the concentrate is washed with acid, al-kali and water. It is first agitated with one-tenth its volume of 0.01 N sulphuric acid, then settled and separated. It is then extracted with an equal volume of 5 percent sodium bicarbonate solution, and again settled and separated. It is finally agitated with an equal volume of de-ionized water and again settled and separated. In each case the extracts are collected and returned to the aluminum feed tanks for the Podbielniak extractor. The washed amyl acetate extract, still comprising about 40 gal. is then charged into a small glass vacuum crystallizer where the remaining amyl acetate is vaporized and condensed at 100 deg. F., and the residue, containing the crude Chloromycetin crystals, is reduced to a volume of about 2 gal.

The crude crystal containers are car-

The crude crystal containers are carried to a refrigerated room where they are held for 8 hr. at 40 deg, F. to complete the crystallization. The material is then manually filtered on a stoneware suction filter and the partially purified crystals are charged in trays into a vacuum dryer for removal of the remaining solvent.

From the dryer six batches of crystals are combined and charged to a 200-gal. recrystallizer, provided with low-pressure steam on the jacket. The crystals are slurried with about 70 gal. of water and mixed with one-tenth their weight of decolorizing carbon. Upon heating to 200 deg. F., they go into solution in the water. Chloromycetin is very sparingly soluble in water at room temperature, a fact which is the basis of the recrystallizing step. Furthermore, in distinction to penicillin, a Chloromycetin solution can be boiled for a fairly extended period without deterioration. The slurry of decolorizing carbon and Chloromycetin solution is then dropped hot from the solution vessel to a 12-in. Shriver plate-and-frame filter press which has been preheated. The clarified solution is further polished in a heated Selas ceramic filter and the hot concentrate then flows to an open 75-gal. crystallizing tank equipped with a jacket. Here the crystallization is completed at about 40 deg. F., using

chilled water on the jacket. The purified crystals are then filtered out on a stoneware suction filter and washed with de-ionized water, the water and mother liquor being returned to the extractor feed tanks. The finally purified crystals are then removed manually from the filter to an atmospheric tray dryer from which they are transferred to a Micro Pulverizer for final reduction prior to screening, packaging, and shipment.



#### Synthetic Process for Chloromycetin

ALTHOUGH the synthetic process is a relatively complex one, involving ten reactions and a total of about 30 steps (not including various recovery operations), it has a number of obvious advantages compared to the biological process. For one thing, it requires much less operating space for a comparable output, and it is free from the contamination problems inherent in any fermentation process. Also, much smaller quantities of materials are in process at a time. However, only study over an extended period will permit a full economic com-parison of the two processes, and thus show whether one or perhaps both will be the survivor.

The chemistry of the process has been described in detail by Long and

Troutman, in a paper in the July 1949 issue of the Journal of the American Chemical Society. However, it will be desirable to sketch over the The starting raw reactions hastily. material is p-nitrobromacetophenone. which is available on the market and so need not be synthesized in the plant. This material is first condensed with hexamethylenetetramine (methenamine), then hydrolized with ethyl alcohol and muriatic acid, and acetylated with acetic anhydride and sodium acetate. The resulting product is subjected to hydroxymethylation with formaldehyde and sodium bicarbonate, the product reduced with aluminum isoproplyate, then hydrolized with muriatic acid. Following neutralization with caustic soda, the isomer

mixture resulting is separated by reaction with d-camphorsulphonic acid, the desired isomer recovered by neutralization with caustic soda, and the resulting product reacted with methyldichloracetate to yield Chloromycetin. These ten reactions are indicated, together with the associated equipment, in the accompanying flowsheet. The process logically divides itself into eight major steps, of which the first four, being similar in the unit operations employed, are grouped together. The fifth reaction and its associated steps form a separate group, as do the last three.

The process is conducted on a batch basis, most of the equipment being of standard character. In several cases, the same equipment is used for two or more operations.

In general, vacuum for the various stills is produced by three sets of two-

stage, non-condensing steam jet ejectors. Vacuum for the several vacuum dryers is obtained from a three-stage steam jet equipped with intercondensers. General vacuum, required for filtration, partial evacuation of receivers, and other miscellaneous uses, is supplied by a Nash vacuum pump. All kettles and stills are jacketed and provided with 40-psig. steam, as well as chilled water for cooling purposes. Ejectors all operate on 80-psig. steam.

The first four reactions, shown in the top line of the flowsheet, involve the use of three 1,000-gal. kettles, all provided with variable-speed drives on the agitators. This group of opera-tions also employs a 500-gal. still for recovering monochlorobenzene, a 40in. bottom-discharge centrifugal, a 1,000-gal, tank for neutralizing alcohol before recovery, and atmospheric

In this series of operations, the raw material, p-nitrobromacetophenone, is condensed in one of the 1,000-gal. kettles with hexamethylenetetramine in the presence of monochlorobenzene. The reaction mass is brought up to temperature and dropped to the 40-in. centrifugal for recovery of the crystals of condensation product. Since the crystals are very fine, the removal of liquor is difficult. The liquor is pumped to the 500-gal, copper still for recov-ery of the monochlorobenzene, while the condensation product is carried to to a 1,000-gal, tank for the hydrolysis

The crystals are now mixed with ethyl alcohol and muriatic acid under agitation and raised again to reaction temperature. The mixture is cooled, separated from the alcohol in the centrifugal, and washed with water. The acid alcohol mixture flows to a 1,000-gal. storage tank where it is neutralized prior to alcohol recovery, using soda ash. The cake removed from the centrifugal is charged into a 1,000-gal. kettle and agitated with acetic anhydride. Sodium acetate is then added and the mixture stirred until acetylation is complete. Crystals of the acetylated product are cooled, recovered in the same centrifugal, washed and transported to the hydroxymethylation step. The separated liquors are discarded.

For the next reaction the crystals are charged to a 1,000-gal. kettle, together with formaldehyde, ethyl alcohol, and sodium bicarbonate solution. Under agitation the mixture warms sufficiently from heat of reaction. It is held until the reaction is complete, after which it is cooled, separated in the same centrifugal, washed with water, and the crystals of p-nitro-a acetamido-β-hydroxypropiophenone are

dried in an atmospheric tray dryer. The liquors are discarded.

The fifth step, which consists in the reduction of the dried ketone from step (4) and its purification to produce dl-threo-1-p-nitrophenyl-2-acetamido-1,3-propanediol, involves a succession of reactions (with separation of acetone), recovery of isopropanol, separation of aluminum hydroxide, evaporation, charcoal treatment, crystallization, filtration and drying. If needed to secure the necessary purity, one or more recrystallizations may be employed. The mother liquors are worked up for a second crop of crystals. This sequence of operations requires a 500-gal. still, with a packed fractionating column; a second 500gal. vacuum still, with an agitator; a 300-gal. kettle; a filter press; several storage tanks; two 36-in. diameter stoneware suction filters; and atmospheric dryers.

The ketone from step (4) is charged into the 500-gal. fractionating still for reduction with aluminum isopropylate in the presence of anhydrous isopropanol. During the distillation the isopropanol refluxes and the acetone produced is separated. The mixture is then pumped to the vacuum still for the recovery of dry isopropanol for reuse. Water and 80 percent iso-propanol are added to the hot residue, which is agitated, heated and refluxed for a time. The aluminum hydroxide produced is removed in the filter press and washed with 80 percent isopropanol, after which the press cake is dis-

carded. The filtrate and washings are accumulated in a 1,000-gal, tank, then evaporated to dryness in the vacuum still for recovery of the isopropanol. The residue in the still is dissolved in hot water, agitated with decolorizing charcoal, and pumped through the filter press to a holding tank where the solution is cooled to crystallize the product. The crystals are separated in the suction filters, washed with water and dried. Should the purity not be up to standard, recrystallization may be resorted to, either before or

after drying.

At this point, it should be explained that the product of the fifth reaction is mixture of four isomers. Two of the four isomers produced in the reduction step are eliminated in the purification and water crystallization of this product, leaving the other two to be separated. Therefore, it is necessary-after hydrolysis and neutralization of the step (5) product—to react with a compound which will carry the unwanted isomer into solution, but permit recrystallization of the desired levo product. The separating compound is recovered by neutralization of the dissolved I-salt crystals and the resulting I-base is reacted with methyldichloroacetate to yield the crude Chloromycetin which is recrystallized and dried as finished product.

For the last group of steps the equipment includes two 1,000-gal. kettles, both equipped with variable-speed agitators; two 500-gal. reactor-stills with reflux condensers and agitators; two 36-in. stoneware vacuum filters (which are to be replaced with a 48-in. centrifugal); and two vacuum dryers. The dl-threo-1-p-nitrophenyl-2-acetamido-1,3-propanediol from step (5) is first hydrolized in one of the 1,000-gal. kettles, by use of muriatic acid. Decolorizing carbon is then added, the kettle contents agitated, and the solu-tion is filtered. The carbon cake is flushed off to waste while the solution is cooled in the 1,000-gal. kettle, then neutralized with sodium hydroxide. The resulting dl base is then separated from the waste liquor on one of the stoneware filters, washed and dried in a vacuum dryer. The dry product is now dissolved in butanol in one of the 500-gal. stills, and reacted with d-camphorsulphonic acid which takes the unwanted isomer into solution. On cooling, the desired l-salt crystallizes out and is separated on a stoneware filter. The filtrate is worked up for recovery of the butanol, d-base and d-camphorsulphonic acid, while the I-salt crystals are dissolved in water, then decomposed by addition of so-dium hydroxide. The solid l-base is separated by filtration and washed, while the filtrate is saved for recovery of d-camphorsulphonic acid. After the I-base crystals have been dried in one of the vacuum dryers, they are charged into one of the 500-gal. stills, methyl-dichloracetate is added, and the mixture heated to complete reaction to crude Chloromycetin. After cooling the crude crystals are filtered on a stoneware filter and then are recrystallized from water by heating, followed by cooling. The resulting crystals are filtered off, the mother liquors saved for a second crystal crop, and the purified material is vacuum dried as final product.

In concluding this account of pioneering work, we wish to acknowledge the enthusiastic support and assistance of several members of the Parke. Davis staff, particularly Harvey M. Merker, superintendent of manufacturing, W. H. Mohrhoff, superintendent of the antibiotic division, E. F. Lau, manager of antibiotic manufacturing, and also Messrs. Ralph Hummel, Russell Van House and W. F. Roser, chemical engineers associated with the synthetic development.

- 1. Know your product's properties.
- 2. Know where, how and why it is used.
- Convey your knowledge to present and prospective customers.
- 4. Study competing products.
- Try to adapt your product to lucrative non-using industries.
- If you lack facilities, use independent or customers' laboratories if necessary.
- Organize interest in specifications and methods of test for your products so the public can get them from ASTM, ASA, governmental groups, and trade associations.
- 8. Streamline your handling of customer relations.
- Keep your products abreast or ahead of competing items.
- 10. Remember customers are buying more than the product; they are buying the job the item will do, and a piece of the total effort that went into development of your product.

## Ten Steps to Higher Sales

Plenty of attention is needed to keep markets for old-line chemicals growing

#### W. J. BILEY

Maintenance and expansion of known and new uses of old or established chemicals are relatively more important than the commercial developments of new chemicals. In fact, this importance grows as each new chemical matures and graduates to old chemical status—a regular production and sales item.

Consideration of old chemicals may prove helpful in solving some of the problems associated with new chemical development. With old chemicals the primary agencies are production, sales, consumer (established and potential) and competitor. On new chemicals these agencies are primarily research, sales development, potential customer, and potential competitor. Also, in contrast with new chemicals, it is certainly easier for the manufacturer of an old chemical to justify expenditures for additional plant capacity, applications research or process improvement since he knows production costs, that prices are reasonably firm, and that known or potential markets are well established or easily estimated. For example, it is a matter of simple arithmetic to determine

that a reduction in cost of 0.1c. per lb, of an old chemical produced at the rate of 100 ton per day can mean a sivings in round numbers of \$70,000 per year-less taxes of course. Similarly a 10 percent increment in 100 tons per day production, assuming a labor and overhead cost of \$200 per day which is unaffected by this production rate, the savings can approach \$7,000 per year. The potential consumer, on the other hand, secure in his sources of supply and with these factors well established can more easily justify his application and process research. Fortunately, for our over-all economy and welfare, the competitor can also evaluate his potential stake and act accordingly. Perhaps the higher degrees of certainties are another reason for the lack of published consideration of old chemicals. Perhaps the job was considered done, of insufficient importance or too routine to warrant detailed consideration. Yet it must be remembered that new chemicals owe their birthright to the availability and carnings of old chemicals and the techniques that were developed in marketing them.

In an attempt to evaluate some of the factors relating to and the methods in use by chemical companies for maintaining and developing markets for old chemicals a letter was sent to 49 members of CCDA and CMRA asking how their particular organization handled certain phases of the problem. Responses by mail and by personal contact were gratifying and indicate considerable interest in this problem. Twenty-eight replies contained sufficient information to be of value.

#### THE PROBLEMS INVOLVED

The problems are extremely complex, no two organizations do things exactly alike; some organizations are relatively simple and involve few people, others are large, in fact are groups of what might be considered large separate companies and involve many people. In some instances sales are handled by exclusive sales agents. such as Enjay Co., a subsidiary of Esso Standard Oil Co., and General Dyestuff Corp., selling agents for General Aniline and Film Corp. The products vary in number and natureorganic, inorganic, naturally occurring and synthetic, liquids, solids. They vary tremendously in end uses, some being confined predominately to a single use and others have almost universal use. The organizations promoting and supporting sales vary from very small ones, to complex organizations with different functions handled by large groups.

Yet despite these complexities and variances there is a fairly high degree of fundamental similarity. The fundamental functions are carried out in all instances and the major differences lie

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in the degree to which functions become specialized or departmentalized. This is largely a question of size and

stage of evolution.

In the earlier days, when the industry started and when companies were small, sales and production were frequently handled by the same individual and there was little or no service. The need for chemical control became apparent and works laboratories were set up and simple customer problems were usually turned over to these laboratories.

#### GROWTH OF SPECIALIZATION

Additional products were made. As the problem of production and the consumer grew, groups in the works laboratories became more specialized, evolving eventually into control, process development, research and applications expanded and became more highly technical. Competitive forces developed to higher degrees. The need for assisting customers in using prodnets in many instances resulted in the development of highly specialized sales service and market research groups. All of us are in various stages of these developments and in analyzing our daily problems are looking for the most effective and economical methods of organizing our efforts to give speedy and accurate answers to our employers, associates, and our customers. We are

trying to improve on many of these evolutionary changes which were in many instances too haphazard and insufficiently coordinated to meet today's

In most chemical companies individual salesmen are assigned specific geographical territories to cover. In many organizations they sell the complete company line. Their efforts are coordinated locally by a district sales manager who, in turn, reports for coordination purposes to the home office, usually to a product sales manager responsible for a specific group of chemicals generally related by chemical composition. These product sales managers report through sales execu-

tives to management.

The following chemicals are sold primarily on this product basis: acids, alkalis, acetone, alcohols, ethers, phosphates, peroxide, furfural, sodium silicate, halogens, sodium sulphate, soda ash, borax, evanides, sulphides, and chlorinated solvents. Of course, some of these may be sold also on a strictly industry basis and the dividing line is not sharp. Products fall into this group by virtue of basic chemical properties or widespread utility of some simple physical property such as solvency power.

On the basis of information supplied by respondents, the sales of 13 organizations shown below fall in this product classification. In a number of instances, however, specialization either on a product group or industry basis becomes necessary at the district level.

#### Sales Based on Products

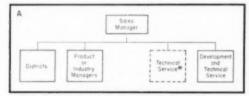
Anonymous 1
Anonymous 2
American Potash and Chemical Corp.
Celanese Corp. of America
Diamond Alkali Co.
Electrochemicals Department, E. I. du Pont
de Nemours & Co.
Hercules Powder Co.
Hooker Electrochemical Co.
Hooker Electrochemical Co.
International Minerals & Chemical Corp.
Jefferson Chemical Co., Inc.
Mallinekrodt Chemical Works
Monsanto Chemical Co.
Shell Chemical Corp.

Actually, an applications or even a unit process classification is more expressive in some specialized lines—for example, the sale of solvents for extraction of activated carbons for adsorption, and of oxygen, acetylene, welding and cutting equipment, and supplies.

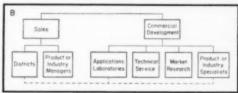
Again, in a non-inclusive illustration, the following industry classifications may be cited: pharmaceuticals, agricultural chemicals, livestock feeds, baking chemicals, plastic molding powders, lube oil adhesives, dyes, fertilizers, laundry and dry cleaning, dairy detergents and disinfectants, refractories, inks, paints and varnishes, explosives, fire extinguisher fluids, ad-

Here Is How 17 Chemical Companies Handle Expansion of Markets for Old Chemicals

| Company                    | Organization Type<br>(See charts) | Technical<br>Service | Old Product<br>Development | Responsible For<br>Maintaining Sales    | Responsible For<br>Expanding Sales               |
|----------------------------|-----------------------------------|----------------------|----------------------------|---|--|
| Anonymous-1                | B                                 | Yes                  | Yes<br>Yes                 | Product Manager                         | Commercial Development & Product                 |
| Anonymous-3                | A                                 | Yes a                | Yes                        | Product Manager                         | Manager<br>Product & Sales Promotion<br>Managers |
| Celanese Corp. of America. | A.                                | Yes."                | Yes                        | Sales Manager & Technical<br>Service    | Sales Manager & Development                      |
| Commercial Solvents Corp.  | A.                                | You                  |                            | Sales Department                        |  |
| Dow Chemical Co            |                                   | Yes                  | Yen                        | Sales Division                          | Davelopment & Technical Service                  |
| Enjay Co                   | E5                                | Yen                  |                            | President & Vice President              | President & Vice President                       |
| General Dyestuff Corp      |                                   | Yen                  | Yen                        | Sales                                   | Sales & Commercial Development                   |
| Hercules Powder Co         |                                   | Yes                  | Yes                        | Technical Service & a Staff Unit.       | Technical Service & a Staff Unit                 |
| Hooker Electrochemical Co. |                                   | Yes                  | Yen                        | Development                             | Development                                      |
| Jefferson Chemical Co      |                                   | Yes                  | Yes                        | Sales Manager                           | Sales Manager                                    |
| Monsanto Chemical Co.      | Α                                 | Year                 | Yen                        | General Manager                         | General Manager                                  |
| Chas Pfiser & Co., Inc.    | A                                 | You                  | Yes                        | Development                             | Development                                      |
| Shell Chemical Co          |                                   | Yes                  | Yen                        | Sales Vice President & Sales<br>Manager | Sales Vice President & Sales<br>Manager          |
| Spencer Chemical Co        |                                   | Yen                  | Yen                        | Product Manager                         | Product Manager                                  |
| Victor Chemical Works      |                                   | Yeu                  | Yes                        | Sales Department                        | Sales Department                                 |
| Westvaco Chemical Division | Α                                 | Yes                  | Yen                        | Product Manager                         | Product Manager                                  |



Most used sales organization has a sales manager on top.



A sales-development liaison system is also widely used.

|                               | Maintaining<br>Sales | Developing<br>Sales |
|-------------------------------|----------------------|---------------------|
| Entire organization           | . 1                  | 1                   |
| President                     | 2                    | 3                   |
| Vice president sales          | . 2                  | 2                   |
| Sales manager                 | . 2                  | 2                   |
| Product sales manager         |                      |                     |
| Sales department (as a whole) | 11                   | 7                   |
| Commercial development        | (2)                  | 8 (4)               |
| (may be part of sales)        |                      |                     |
| Technical service             |                      | ž.                  |
| Staff organizations           |                      | 2                   |
|                               |                      | B.o.                |
| Totals                        | 27                   | 23                  |

sorbent carbons, and carbon blacks. In general, products fall into this classification by virtue of specific physical, chemical, physiological or bacteriological property, or combinations of these. As extremes in this classification we find highly technical fields as well as those industries which are primarily arts.

In 11 organizations shown below sales, including the central organization in some instances, are handled both on a product and industry basis. In two instances sales were broken down on an industry basis.

#### Sales Based on Product and Industry

Anonymous (2)
Commercial Solvents Corp.
The Dow Chemical Co.
Enjay Co.
Mathleson Chemical Corp.
Pennsylvania Sait Mfg. Co.
Chas. Pfizer & Co., Inc.
Sharples Chemicals, Inc.
Shawinigan Chemicals Ltd.
Spencer Chemical Co.
Westvaco Chemical Division

Let us now consider some of the functions required to support the sales effort. Just how are the problems of maintaining sales and developing new sales handled? First considering sales for established uses and starting again with the individual territorial salesman, it was found in many instances that the uses of his products were simple, well established, and his experience sufficiently broad so that he could personally handle the usual service problem and sales prospect. In rare instances he needed some additional help and called upon someone cither from production or research, who had more technical experience with the product, for assistance. Only in one such instance did an organization report that this was the case for all its products. In several instances, however, some parts of the field forces function on this basis. With proper technical training or experience this is a highly effective and economical method of solving many of the problems encountered.

As we proceed up the evolutionary scale we find various stages of development and refinement. In 23 instances central technical service functions were found to report directly to some part of the sales organization in 18 cases. In five instances technical service functions are either part of research or a sales development group occupying about the same level in the organization chart as sales.

Destropsibility for

In four cases the central technical service functions were duplicated in the sales districts with organization on the specific theory.

the product basis.

Looking at the picture a little more closely and considering sales as consisting of a vice president, sales manager, and product managers, we find the breakdown as shown in the ac-

companying table.
A simplified organization chart has been, prepared and an attempt made to classify individual companies where sufficient information was available, in order to give a more detailed picture of the manner in which they handle service, expansion of markets for new uses of old chemicals, and to indicate where responsibility for these functions lies. Again, it must be remembered that no organization is as simple as indicated. Considerable liberties have been taken in the organization charts of some individual companies in order to fit them into the simplified pattern.

The pattern into which the largest number of organizations fit is shown in Chart A.

The next most common type of organization is shown in Chart B where technical service and old product development are divorced from sales and are handled by a commercial chemical development group. In three reported instances, these functions are divorced from sales and are a part of the technical department. In two instances these functions are under the direct control of the product sales manager.

The effectiveness of the product manager in carrying out his functions is determined in a large measure by the support he receives from his own staff and the staffs of supplementing

With minor exceptions, existing service organizations indicated that their personnel was technically trained. One specific exception was noted, however, and that is in the

sales and servicing of fertilizers—men with experience in the field are preferred.

All of these complex factors—type of sales organization, the positions of service and development groups in an organization in relation to research, sales, and production, and the degree of responsibility of each in continuing the development of old chemicals and particularly the relationship of this responsibility and degree of direct control over laboratory facilities can only be resolved in the ultimate analysis by the individual company.

Laison functioning of service groups has been the result of the need of correlating activities that have been superimposed on existing facilities. However, the question naturally arises as to whether this is the most effective way of meeting today's problems. Consideration of the basic factors associated with these problems can develop a more thorough understanding of the principles to be followed by individual companies.

#### SALES PROMOTION TOOLS

Chemical advertising literature, such as catalogues, brochures, bulletins, leaflets, and data sheets, is one of the tools employed in promoting sales. There is considerable variation in extent and type of information given on old chemicals even by a single organization, to say nothing of the industry as a whole. In this survey an attempt was made to explore existing attitudes and policies regarding the subject. About 96 percent of the respondents were in favor of using this tool and thought it was necessary. This was the only area in which there was a high degree of agreement.

There appears to be fairly general agreement that chemical and physical properties, known and suggested uses, shipping containers, and depending upon the type of literature and product, detailed use instructions should be included.

The controversial area appears to the extent and form in which specifications and analytical data are given. In some instances only assay is given: in others, specifications showing minimum assay and certain maximum impurities are given. In others, analyses are given. The job is sometimes made tough for the purchaser by not defining the terms or giving loose definitions, such as average or typical. These points can frequently be important and may govern his choice of supplier. Hesitancy in publishing or supplying complete analytical data is due to the adverse effects it might have on production as the result of special requests by customers. Although each case must

be considered individually, it would certainly seem possible for the industry to do a better and more consistent job.

#### DEVELOPMENTAL INFLUENCES

The people who cooperated in this study were also requested to give an expression of their experience on the relative influences of external (customer demand) and internal (applica-tions research) factors on the develop-ment of old chemicals. There were some interesting replies to this question. By a ratio of 4 to 1, experience indicated the influence of external factors to be the major one. In several instances experience indicated that the balance was about even. Two companies expressed diametrically opposite viewpoints on policy regarding this matter. One indicated that efforts were primarily directed toward acquainting potential consumers with the chemistry of his product so that everything possible was done to stimulate external interest. In the other instance the idea was expressed that the manufacturer should carry the ball on uses and applications of his product. However, strictly chemical and less specialized use applica-tions developments on old chemicals result primarily outside the manufacturer's organization, as also is the case usually with new chemicals.

Despite conflicting statements, consideration of some of the factors lying behind them indicates that each may be right in this patricular case. For example, the nearer the product application lies to the consuming public the greater the responsibility assumed by the manufacturer in developing new uses. To be specific, it is hardly likely that uses such as nematode control with ethylene dibromide (an old chemical) discussed by D. K. Ballman of Dow Chemical at CCDA's March 1948 meeting or repelling insects with an old plasticizer, dimethyl phthalate, could be developed without the availability of highly specialized applications laboratories and highly efficient and closely coordinated technical effort that was required to bring these developments into commercial application.

On the other hand, very little application work is required by the manufacturer of such basic chemicals as sulphuric acid, chlorine, or phenol. These chemicals and their applications are well known and this knowledge is part of the basic technical background of every chemist and chemical engineer. The continued growth of such chemicals is usually looked upon as the application of the known rather than a new development when they are used in making a

new compound. The manufacturers of such basic chemicals are more likely to follow the development of new chemicals in which their own basic chemicals are used, than they are to develop new chemicals in which they have no fundamental raw material position. Dow's internal use of the chlorine they produce is an excellent illustration of this principle.

There are other internal factors which should be considered. One of the major contributions made to any chemical development is price reduction. This usually results from economies resulting in process improvement, increases in production capacity, or a deliberate move with a view of capturing a new market or, perhaps, a greater portion of an existing market. Competitive pressure of new products for the same use as the old product is also a reason for reducing price.

Another factor contributing to expansion of markets, which lies under the direct control of the manufacturer, is chemical quality improvement. Customers do not buy a material on which they must perform purification steps before they can use it, or if they do, it doesn't last very long. Neither will they tolcrate impurities that reduce their yields, interfere in processing steps, or effect the quality of their final product in any way. These situations result in special demands on the producer and present major difficulties to him, since he has achieved his position by mass production of a given quality at a stated price. If the customer is a large and important one, entire production capacities may be swung over to the new and improved specifications. If the customer is not quite so large, material from run of the mill production which meets the requirements is selected. In some instances the effect of minor impurities may be so important to the consumer that he is willing to pay a premium and, if the manufacturer is successful in meeting the customer's demand, a new grade of an old product becomes available. Hooker's sodium sulphide is an example of this. Long range the culminative effect of such demands is an improvement in quality to everyone and at a lower price.

Price reductions and major quality improvements are spasmodic in nature, usually the culmination of long research programs on fundamental quality and process improvement. However, daily control over the variables effecting quality and costs is vigilantly maintained. Process control groups are constantly at work to develop maximum efficiencies, to eliminations.

inate bottlenecks, and to improve quality.

The problem of disposing of coproducts (or byproducts) which increase in direct proportion to the production of the main product is also a strong motivating internal factor. Such problems can account for expensive and long range research projects, such as the studies under way for the utilization of HC1 produced by hydrocarbon chlorination. The increasing demand for chlorine and the economic necessity of disposing of the electrolytic coproduct, caustic soda, led Columbia Alkali to the development of their ammonia extraction process for reducing the salt content of the caustic. Reduction in salt content from 1 percent to between 0.10-0.15 percent and the chlorate content from 0.10 percent to 2-5 ppm. made a product comparable to lime-soda caustic and opened the rayon market to electrolytic caustic for the first time.

#### CONSUMER-PRODUCER COOPERATION

The dovetailing of consumer-producer interests is also a major factor in the growth of old chemicals. Most manufacturers have little difficulty in handling production increases when a large potential customer comes forward with a concrete proposal to purchase several thousand tons per year of one of the manufacturer's basic products. Whether or not the manufacturer accepts the proposal is usually a policy decision based upon relative position in the overall market, availability of capital, and relative profit returns on the capital in view of other developments under consideration. It is not uncommon to find capital being supplied jointly with the formation of new companies or wholly owned subsidiaries, by organizations respectively wanting and having certain raw materials available.

While improvement in chemical quality has been mentioned as a means of increasing uses, modification of physical forms and properties to improve the economic utility of the product and the process in which it is used, is another fundamental approach.

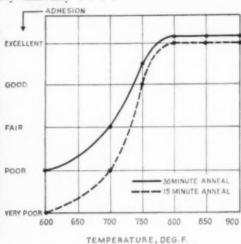
The ways and means of continuing the development on an even higher plane are limited only by boundaries of our imaginative ability to apply our technical knowledge in logical and scientific fashion. Continued cooperative effort will push these boundaries further into the unknown.

Acknowledgement: Sincere appreciation is extended to those organizations which cooperated in providing the data which made this paper possible.

#### Experimental equipment eliminates an early difficulty . . . .



Laboratory apparatus set-up used in gas plating experimentation for determination of optimum plating conditions.



Blistering was an early problem solved by annealing. Graph shows effect on adhesion of annealing temperature and time.

## Metal Plating from Carbonyl Gases

Compared with electroplating, gas plating is faster, gives better reproduction of irregular surfaces, and is applicable to non-conductors such as wood and glass

Gas plating by decomposition of metallic carbonyls is not a new process. But Commonwealth Engineering Co., Dayton, Ohio, whose engineers supplied data for this digest, is finding new applications.

Ludwig Mond started the ball rolling in England in 1590 when he chanced upon the first gas plating phenomenon while studying the effects of finely divided nickel on carbon monoxide. The same commercial process which he later developed and which now bares his name is still used in Europe today for the production of metallic nickel.

Using variations of the same principle Commonwealth has developed and patented a process for nickel plating objects of various sizes, shapes, and materials. To date the process has only been operated on experimental equipment. Continuous commercial units are now in the engineering stages.

#### ADVANTAGES

While not looked upon at present as a likely replacement for all electroplating, gas plating is expected to find extensive use for specific applications to which it readily lends itself. Materials which cannot be handled by wet electrochemical methods but which can stand the required 400 deg. F. will be gas plated. Among others this includes ceramics, tiles, glass, and wood.

Probably the biggest single advantage of the new process is increased rate of deposition. On a recent test 13 lb. 6 oz. of nickel were deposited on a small table top during a 60-min. plating cycle. Another plating which took 30 min. by the conventional process was deposited in 4 sec. by Commonwealth.

The excellent reproduction of irregular surfaces, internal areas, and complicated structures achieved by the Commonwealth process indicates a bright future for it. Then too, elimination of complex plating baths, delicate solution balancing, and the problem of applying power to irregular surfaces point to a permanent berth for gas plating in the future. Considcred still another important advantage is the ease with which the process can be adapted to continuous operation as, for example, in the manufacture of coated sheets rolls or the integrated production of laminates

#### THE PROCESS

In equation form, the story is very simple. Nickel carbonyl is formed in two steps:

 $Ni + O_z \rightarrow NiO_z$ 

and at 113-194 deg. F.

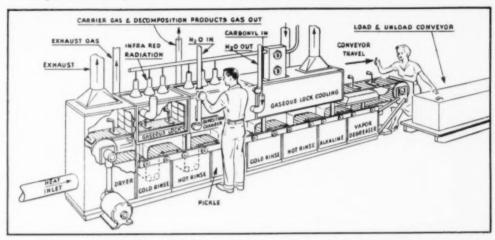
NiO<sub>2</sub> + 6CO → Ni(CO)<sub>4</sub> + 2CO<sub>4</sub> Deposition takes place at 356 deg. F.:

Ni(CO), → Ni + 4CO

In actual practice it is not quite that simple. Materials to be plated are first thoroughly cleaned. This is done by a standard process similar to that for electroplating (as shown in drawing of commercial plating unit) or by a gaseous reducing atmosphere.

Before the process begins the deposition chamber, where plating takes place, is flushed with inert gas to rid it of all traces of oxygen. Gas content is checked with an Orsat gas analyzer. When the oxygen content is nil the piece to be plated is heated to decom-

#### . . . . points the way to this full-scale production unit of the future



Complete commercial adaptation is the goal of Commonwealth engineers. Here is a sketch of a commercial unit now under construction. Note the manner in which they have adapted the process to continuous operation.

position temperature. This is done by dielectric radiation or conduction, depending upon the size and shape of the object. Heating is probably the most important problem that must be solved for each application to get satisfactory results. Thermal balance must be maintained throughout the decomposition period to insure even plating. It is essential that heat be concentrated in the object being plated during the plating operation. A water jacket keeps the rest of the tank below decomposition temperature.

The plating atmosphere is generated in a hot rolled steel cylindrical carburator. This vessel is first purged with inert gas after which a 5-lb. shot of liquid nickel carbonyl is introduced. Inert "carrier" gas (usually hydrogen) is then bubbled through the 4-in. depth of carbonyl, forming a plating atmosphere of 20 percent Ni(CO), and 80 percent carrier gas by volume. This mixture is piped to the deposition chamber where it is sprayed by jet at the object to be plated. To prevent intragaseous decomposition of the carbonyl, the jets are vapor cooled and located close to the target.

To maintain atmospheric pressure when Ni(CO), forms Ni and 4CO in the deposition chamber and to overcome exhaust line friction, a centrifugal fan is placed in the exhaust line. The fan blows the gases to a burner where they are burned with natural gas in the atmosphere.

Plating operation completed, the chamber is flushed with dry nitrogen to rid it of Ni(CO), vapor, hydrogen, and gaseous products of decomposition. The exhaust gases are analyzed to determine when the deposition chamber may be opened with safety for removal of the part.

#### DISADVANTAGES

The process has its pitfalls. Both Ni(CO), vapors and liberated CO have toxic effects on the human body. For protection of operators provision must be made for gas tight equipment and proper disposal of waste gases by burning.

Nickel carbonyl is a strong reducing agent. Mixed with oxygen it may explode violently at temperatures as low as 60 deg. C. This explains the thorough flushing of both carburator and deposition chamber with inert gases before introduction of Ni(CO).

During early experimental stages, difficulty was encountered in the deposition of thick nickel plates due to lack of adhesion and continual blistering. A layer of gas between the nickel plate and the base metal was found to be the cause. The difficulty was eliminated by the following process: (1) Cleaning the base material by abrasion, (2) depositing a thin flash coat of nickel, (3) annealing at 800 deg. F. or above (see graph), and then (4) deposition of the desired thickness of nickel.

#### TEMPERATURE RANGE

Tests show that decomposition temperatures for maximum efficiency are between 350 and 395 deg. F. Above 400 deg. F. the decomposition of nickel carbonyl is 100 percent complete. However at these higher temperatures finely divided nickel acts as a catalyst to accelerate the dissociation of carbon monoxide into carbon and carbon dioxide. This reaction results in the deposition of a heterogeneous mixture of nickel and carbon. Such mixtures have no commercial value at present. Below 350 deg. F. the decomposition rate of nickel carbonyl rapidly approaches zero.

Deposition of nickel has been tried at both low and high plating atmosphere velocities. Test results indicate that the ductility of the deposited nickel plate varies inversely to the rate of deposition. Further investigations are being made in this field.

#### OTHER METALS

Nickel carbonyl, a volatile liquid at room temperature and pressure, lends itself readily for carburation with inert carrier gases. This coupled with the metallurgical properties of nickel make it a natural for gas plating. But it is by no means the only metal to which the process applies. Iron, chromium, tungsten and molybdenum have all been applied to base metals by the Commonwealth method. Copper, iron, and lead bases have been prepared and studied extensively in connection with gas plating. And according to Commonwealth this is just the beginning. The goal-complete adaptation for commercial operation.

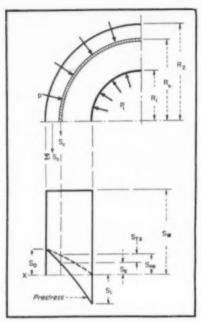


Fig. 1-Typical stress distribution diagram for ideal prestressed vessel construction.

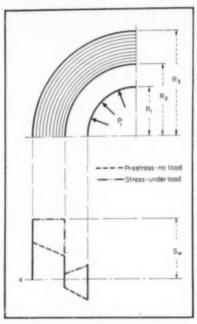


Fig. 2-Typical stress distribution for a ribbonwound prestressed pressure vessel.

## Practical Design of Prestressed Pressure Vessel Shells

This last of three articles on design of vessels for high pressures deals with practical prestressed designs. Earlier articles appeared in August and September

R. R. MACCARY and R. F. FEY

To meet the demand of large scale and economical chemical production today, many new processes must not only operate under unusually high pressures, but also with the continuous flow of large volumes. Such requirements entail the development and design of high-pressure vessels of considerable volume, which means relatively large diameters and heavy shells.

In the first article of this series (Chem. Eng., August 1949, p. 124) the thick-walled, non-prestressed vessel was discussed and design methods considered. However, limitations on the manufacture and the economics of the solid, non-prestressed forged shell have resulted in the investigation and application of other methods of design and construction, employing prestressing. Theory and design of prestressing verse considered in the second article (Sep. 1949, p. 105).

These new methods may be divided into two general classifications; first, those using relatively thin plates, sheets or bands to build up a shell of the required strength, with incorporation of varying degrees of prestressing during fabrication; and second, methods of prestressing a solid thick wall.

In the second article of this series it was noted that the ideal use of the material in a thick-wall vessel shell is to develop a uniform tension equal to the allowable working tensile stress of the shell material throughout the entire thickness of the shell wall. Such a condition is produced only under the condition of "ideal prestressing."

It is the intent of this article to present the necessary design criteria for various forms of construction which approach the ideal prestress pattern. An understanding of underlying principles becomes necessary before the vessel designer can conveniently analyze and apply the design equations.

The following discussion is a derivation of the law which must be followed in applying prestressed layers of any form, so that uniform tension

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(i.e., "ideal prestress") will be achieved throughout the layers when the structure is subjected to the design pressure. With reference to Fig. 1 and the second article of this series, the necessary relations may be derived based on the Lamé formulas for stress distribution. Consider the following notations:

Let  $P_1$  = internal design pressure; p = pressure exerted on a layer x by layers applied outside it;  $R_1$  = inside radius of vessel;  $R_2$  = outside radius of vessel;  $R_2$  = radius of layer x;  $S_2$  = design tensile stress of layer material;  $S_2$  = prestress in any layer x under no pressure (refer to the second article),

$$S_x = S_w - \left[ \frac{P_1 R_1^2}{R_2^2 - R_1^2} \left( \frac{R_2^2}{R_2^2} + 1 \right) \right];$$

 $S_{up}$  = stress of application of layers;  $S_{up}$  = compressive stress imposed on layer x by pressure p;  $S_{up}$  = tensile stress equal to and relieved by  $S_{up}$  during fabrication;  $\Sigma S_u$  = summation of prestress (at no internal pressure) in the layers outside of layer x; and C =  $P_iR_i^{*}/(R_i^{*} - R_i^{*})$ .

The design problem resolves itself in the determination of the composite thickness of shell, either of laminar, ribbon or wire construction, and the stress under which each layer must be applied.

The shell thickness may be deter-

mined by applying the ideal prestress formula (from the second article):

$$t = R_1 - R_1 = P_1R_1/S_{\varphi}$$
 (1)

In applying any layer x, a tensile stress  $S_{zx}$  equal to the compressive stress  $S_{cx}$  imposed by p on layer x must be added to  $S_x$  to obtain the tension of application  $S_{xy}$ .

The summation of the stresses in the outer layers beyond layer x is

$$\begin{split} \Sigma \; S_{\sigma} &= \int_{R_{\sigma}}^{R_{0}} \left[ S_{\omega} - \frac{P_{1}R_{1}^{2}}{R_{0}^{2} - R_{1}^{1}} \right. \times \\ & \left. \left( \frac{R_{0}^{2}}{R_{\sigma}^{2}} + 1 \right) \right] dx \\ \Sigma \; S_{\sigma} &= \left( S_{\omega} - C \right) \left\langle R_{0} - R_{\sigma} \right\rangle - \\ & C \left[ \left\langle R_{0}^{2} - R_{0}R_{\sigma} \right\rangle / R_{\sigma} \right] \end{split}$$

The summation of the prestress may be expressed in terms of an externally applied pressure as

$$p = \sum S_x/R_x$$

By the Lamé formula, the stress produced by such an external pressure p

$$S_{tx} = S_{ex} = p \left( \frac{R_x^2 + R_1^2}{R_x^2 - R_1^2} \right)$$

Therefore

$$S_{ts} = \frac{\sum S_s}{R_s} \left( \frac{R_s^2 + R_1^2}{R_s^2 - R_1^2} \right)$$

and by definition:

$$S_{ap} = S_x + S_{tx}$$
  
=  $S_x + \frac{\Sigma S_x}{R_x} \left( \frac{R_x^2 + R_1^2}{R_x^2 - R_1^2} \right)$  (2)

This is the stress of application required to develop a prestress pattern throughout the layers so that under design pressure  $P_1$  all layers will be stressed uniformly to the design stress  $S_n$ .

#### FLAT RIBBON WINDING

A method which permits the attainment of prestress construction with unusual control of the prestress pattern is the band or ribbon-winding system, similar to the wire winding employed in reinforcing gun barrels. The principle consists in winding a steel ribbon helically on a core shell, with progressively varying tension in each layer applied, which results in an initial state of stress in the combined coil and core shell.

This method facilitates manufacture in strict accordance with design calculations, by applying a ribbon winding over a heavy-walled core shell which is of sufficient thickness to carry the axial pressure forces. The winding need only carry the circumferential tensile forces. Furthermore, the windings can be applied with predetermined tension in such a manner that each layer will be under uniform tension when the internal pressure is applied. The distribution of stresses throughout the core shell will, of course, follow the Lamé formula. Such a construction possesses inherent advan-

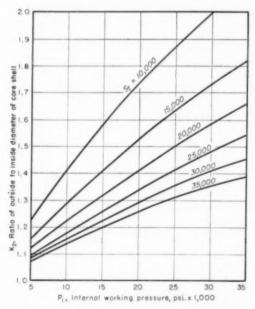


Fig. 3-Design chart for dimensions of core shell based on Eq. (3).

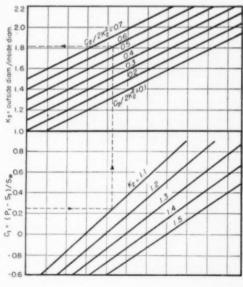


Fig. 4-Design chart for over-all vessel dimensions based on Eq. (4).

tages not found in other designs. The attachment of end closures is considerably simplified, with circumferential welding of the shell seam approaching the minimum required to carry the

axial stresses properly.

The principal design calculations involve the determination of the core shell and winding thicknesses, as well as the tension under which each layer of the ribbon must be applied. Such design formulas have been fully developed by Comstock based on the use of materials of the core and windings having equal moduli of elasticity. The dimensions of the ribbon are governed by the maximum tension that can be developed on the winding machine or lathe, and may be readily varied to use commercially available strip steel. The core shell may be either a forging or of pressed plate and welded construction where diameter and thickness permits.

In the design of such a vessel, the values available are the internal diameter, as dictated by volumetric requirements, and the working pressure of the process. After selecting the materials of construction, the allowable working tensile stress of the core shell is determined, as well as the permissible tension in the ribbon under full load. Generally, the allowable tension of the strip steel is considerably higher than the core shell material, which permits a material reduction in weight of the vessel.

Since the applied ribbon winding can carry only tangential stress, the inner core shell must be of sufficient thickness to carry the axial load. With this requirement as a basis of design, the thickness of the inner core may be determined for an economical design.

Referring to Fig. 2, the salient dimensions of the vessel are  $R_{\rm b}$ , the inside radius of the core shell;  $R_{\rm b}$ , the outside radius of the core, and  $R_{\rm c}$ , the outside radius of the winding. Then, considering  $K_{\rm c} = R_{\rm c}/R_{\rm c}$  and  $K_{\rm c} = R_{\rm a}/R_{\rm c}$ , the dimensions of the vessel are determined by the formula:

$$K_c^2 = (P_c/S_c) + 1$$
 (3)

where  $S_i$  = allowable tensile stress of the core shell and  $P_i$  = internal design pressure.

To simplify design calculations, the relation of Eq. (3) is presented graphically in Fig. 3.

The value of K, must then be calculated from the following equation to establish the diametral dimensions of the winding (or it may be obtained graphically from Fig. 4):

$$K_1 = K_2 (1 + C_1/2 + C_2/2 K_2)$$
 (4)  
where  $C_1 = (P_1 - S_1)/S_2$ ;  $C_2 =$ 

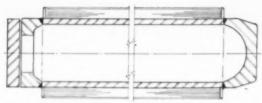


Fig. 5-Typical design for prestressed ribbon-wound or multi-layer pressure vessel.

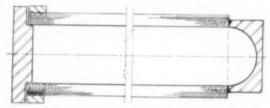


Fig. 6-Typical design for prestressed ribbon-wound vessel with Schierenbeck interlocked ribbon core.

 $(P_c + S_c)/S_s$ ; and  $S_w =$  allowable tensile stress in ribbon winding under full loading by internal pressure  $P_1$ .

With the dimensions of the vessel established, it is further required to check the maximum compressive stress S, which the core shell will be subjected to, as a result of the application of the external winding in tension. The compressive stress expressed by the following formula must be within the allowable working stress for the core material:

$$S_{c} = \frac{\langle S_{t} + P_{1} \rangle - K_{s}^{2} \langle S_{t} - P_{1} \rangle}{K_{s}^{2} - 1}$$
(5)

The tensile stress in the winding must adhere to the relation expressed by the following formula, in order to obtain uniform tension in each layer when the vessel is subjected to the internal pressure P<sub>1</sub>. The tension of application is expressed as:

$$T_{ap} = S_{ap} = \left[ \frac{S_w K_3 (K_x^2 + 1) - 2K_x}{K_x (K_x^2 - 1)} \right] - \frac{2P_1}{K_x^2 (K_x^2 - 1)}$$
(6)

where  $K_r = R_s/R_s$  and  $R_s = radius$  of layer x being applied.

Tension in the completed coil for any value of R, can be calculated, if desired, from the following relation:

$$S_{\nu} = S_{\nu} - \frac{P_1 R_1^2}{R_2^2 - R_1^2} \left(1 + \frac{R_2^2}{R_2^2}\right)$$
 (7)

Ribbon winding construction is applicable for high-pressure vessels, but requires that the maximum advantage be taken of the core material and ribbon material to obtain an economical design. The use of high tensile steel strip is to be encouraged, but maximum utilization will generally be limited by the means employed in winding.

A typical design of ribbon-wound core shell is indicated in Fig. 5. The ends of the ribbon must be securely fastened and the completed winding retained between end rings. A protective shell may be added on the outside to avoid the possibility of damage to the ribbons.

#### INTERLOCKED RIBBON WINDING

A method which has modified the ribbon winding pattern to render each layer capable of carrying the longitudinal forces is the Schierenbeck design.2 This scheme endeavors to interlock the steel ribbon by means of grooved profiles (Fig. 6). The purpose is to impart axial resistance in the winding capable of carrying the longitudinal or axial forces present when the vessel is subjected to internal pressure. The method, however, requires heavy machinery and controls for applying each consecutive layer of bands properly for correct interlock, and also for grooving of the bands with rollers during application. End closures in such a construction require special attention.

The design criteria presented for ribbon-wound shell construction can be applied advantageously in the design of a vessel following the Schierenbeck ribbon pattern. The inner core may be composed of interlocked ribbons without prestress.

To take effective advantage of prestressed designs, the stress of application of each layer of ribbons over the ribbon core must follow the pattern outlined by Eq. (6). Any deviation will necessarily require a greater composite thickness than dictated by the Eqs. (3) and (4).

#### MULTI-LAYER CONSTRUCTION

A method which permits the use of laminar construction is the multi-layer shell, composed of relatively thin shells. For such a multi-layer vessel, it is no longer necessary to shrink each layer over a core shell, nor is machining required. The vessel can be constructed by progressively wrapping and tightening cylindrical sheets of steel over an inner shell, and welding together the longitudinal seam of each layer added. This method has been used by A. O. Smith Corp., and is fully described by Jasper and Scudder.

To obtain a prestress approaching the ideal, and an ideal thickness of shell as expressed by Eq. (1), each layer added must be applied in a controlled manner to insure a stress of application as expressed by Eq. (2). Such a construction is beset with difficulties since a review of Fig. 1 reyeals that the inside layers require a negative or compressive stress of application. This obviously cannot be accomplished with the present fabrication techniques. A construction approaching the ideal prestress may be accomplished by the use of a thickwall inner core, then applying the design criteria for ribbon winding.

In cases where the stress of application cannot be accurately controlled or measured, it is recommended that the multi-layer vessel be considered a monobloe shell, to which the solid thick-wall formulas can be applied to offer a simpler solution. The economy of prestress construction, however, obviously can not be obtained.

#### SPIRAL CONSTRUCTION

A unique modification of prestressing a multi-layer vessel is contained in a patent of Raymond, Creech, and Feagles, wherein the vessel is constructed by spirally winding a continuous shell over a cylinder, and progressively varying the tension of application to approach the prestress pattern. Such construction is, of course, limited in its scope due to restrictions imposed by the machinery required for winding and maintaining proper tension of the steel sheet. Again, it is necessary to use an inner core to obtain a prestress pattern in the spirally wound lavers.

In all cases of multi-layer vessels, end closures may be attached to the full thickness without changing the prestress pattern significantly. However, since the axial loads to be carried by the vessel under internal pres-

sure are always less than one-half of the tangential loads, further economies of construction may be realized by welding end closures to only a sufficient number of layers to carry such loads adequately. The magnitude of the working stress may be modified to accommodate the presence of a combined state of stress in the prestress section of the shell to which the closures are attached. A typical example of an economical multi-layer design is that already noted in Fig. 5, which applies to both ribbon-wound and multi-layered vessels.

#### AUTO-FRETTAGE METHOD

In the several types of shell design so far considered, the vessels have been constructed by combining thin shells and ribbon winding, thereby produc-ing economies compared with solid thick-walled vessels. However, no discussion of high-pressure vessels would be complete without reference to the auto-frettage method. This consists in subjecting a solid thick-walled vessel to internal pressure high enough that the inner section of the wall is stressed beyond the elastic limit and takes a permanent set. When the internal pressure is released the outer section of the wall, which has been stressed within the elastic range, en-deavors to contract. This contraction is resisted by the inner section which has assumed a larger diameter as a result of yielding. The outer section, therefore, remains in a state of residual tension, tending to compress the inner

The design of such a vessel requires a knowledge of stress distribution during initial stages of over-tensioning. Also behavior of the material within the plastic range must be known. It is recognized that the laws of stress distribution beyond the elastic limit depart markedly from those based on direct proportionality between stress and strain within the elastic range. In practice, the over-strain of the inner surface of the shell, depending on the material, has been limited to 2.5 to 6 percent. The system of stresses becomes involved, but must be deter-

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1. Comstock. C. W., Some Considerations in the Design of Thick-Walled Pressure Cylinders, Trans. A.I.Ch.E., 28, 293 (1943).

2. J. Schierenbeck, High Pressure Vessels, U. S. Patent 2,326,176 (Aug. 10, 1943).

3. Jasper, T. M., and Scudder, C. M., Multi-Layer Construction of Thick-Wall Pressure Vessels, Trans. A.I.Ch.E., 27, 384 (1943).

4. Raymond, G., Creech, M. D., and Peagles, R. L., Method of Making Pressure Vessels, U. S. Patent 2,331,504 (Oct. 13, 1943).

5. Kepler, W. R., Method of Making Multi-Layer Vessels, U. S. Patent, 2,337, 247 (Dec 21, 1943).

mined if economical design is to be attained by auto-frettage. The whole process must be regulated by accurate measurement of the strains set up during the over-stressing operations.

Auto-frettage applied to a multilayered vessel of non-prestressed construction is outlined by Kepler, whereby the layers are brought into closer contact by pressuring the inside of the shell until the stresses expand the inner layers beyond the elastic limit and a permanent deformation is obtained.

#### STRESSING BY WELDING

A simple and convenient method of reinforcing a pressure vessel is by taking advantage of the large compressive stresses produced by welding. The construction consists in applying a deposit of weld metal spirally around a core shell, preferably by automatic welding. If the vessel is of considerable length, several weld deposits may be applied simultaneously.

The residual stresses of the welding operation are circumferential and radial compressive stresses. The longitudinal stresses may be compressive or tensile depending on the dimensions of the weld deposit and the pitch of the spiral. Although the stress distribution in the weld metal deposit is involved, the method of construction lends itself to close control by measurement of the strains produced with each layer of weld deposited. With the measurements, empirical relations can be determined readily which permit the design of prestressed vessels in this way. The only disadvantage of this method is the non-uniformity of stress in the weld deposit head, which may show variations approaching the clastic limit of the weld metal.

In concluding this discussion of design of high-pressure vessels, it should be made clear that the application of the design criteria presented permits determining only the necessary dimensions of the cylindrical shell. It cannot be over-emphasized that there are other equally important factors which must be considered in the design. Among them are: selection of material, method of manufacture, determination of correct design stress, and type of end closures to be used. Also of importance are the stress conditions under varying pressure or temperature, the corrosive nature of the vessel contents, and the practical means used in measuring the stress pattern in proper testing of the com-pleted vessel. Development of judgment on the part of the designer best comes from actual knowledge of successful designs of high-pressure vessels already being used in industry.

## Blower and Heat Requirements of Rotary Vacuum Filter-Dryers

To filter a slurry and dry the cake takes hot air. Here is a way to calculate how much air, at what vacuum, and the amount of heat required.

#### L. E. BROWNELL and H. E. CROSIER

Note: This is the second of two articles by Prof. Brownell and his associates. The first, last month, told how to calculate the blower requirements of rotary-drum filters.—Entrop.

THE TOP-FEED filter-dryer was developed to filter crystalline solids that settle too rapidly to be filtered easily in conventional bottom-feed, rotary-drum vacuum filters. Cakes from filter-dryers have high permeabilities and permit sufficient air flow to yield a dry product if preheated air is used. As a result, complete drying of the product has become a primary feature of this filter design.

Selection of the proper vacuum and heating equipment is a particularly important problem in the design of filter-dryers. The methods of calculation presented in last month's article (see note above) are extended to filter-dryers and additional relationships are developed to predict the heat requirements.

#### MECHANISM OF MOISTURE REMOVAL

Moisture removal in any rotary vacuum filter occurs mechanically by fluid flow, and also by vaporization. Using air at room temperature, the amount of moisture removed by vaporization is negligible compared to the amount of moisture removed by fluid flow, and the cakes from such filters are discharged moist. It is not

possible to remove all the moisture from the cake by fluid flow alone, because capillary forces retain a portion of the liquid, called the residual saturation.

In order to reduce the liquid content below the residual saturation, drying must take place. Drying (vaporization) occurs simultaneously with fluid flow and may continue after fluid flow ceases. To increase the drying rate, preheated air is used. In the drying process, the liquid in a moist cake presents so great a surface that the air rapidly becomes nearly saturated with vaporized liquid. Drying starts at the outer edge of the cake, the layer of vaporization progresses inwardly as drying continues and the air leaves the cake close to the adiatic saturation temperature. There is a sharp liquid concentration gradient within this layer of vaporization, the cake above being very dry and the cake below being virtually at the residual saturation. Finally, when the layer of vaporization reaches the inner edge of the cake, all fluid flow in the cake ceases. After passing this point, the drying efficiency decreases

#### DRYING EFFICIENCY

In drying the cake, the maximum amount of heat is recovered from the air if the air is cooled to the moist-cake temperature. Since the drying is an adiabatic process in which all the heat necessary for the vaporization of the liquid is supplied by the air, the air temperature follows an adiabatic path. The ratio of the actual temperature change to the maximum possible temperature change is designated as the drying efficiency.

CRITICAL MOIST CARE THICKNESS

When the layer of vaporization reaches the inner edge of the cake, the drying efficiency begins to decrease rapidly. This break usually occurs at an efficiency of 90 percent or higher. At the break, it is believed that the thickness of the remaining moist cake is equivalent to that of the layer of vaporization. However, as the thickness of the layer of vaporization is not precisely known, an arbitrary definition of "critical moist-cake thickness" is selected in terms of the break in the drying efficiency. The critical moist-cake thickness is defined as that thickness of cake having the residual saturation at the point where the instantaneous drving efficiency is 90 percent. This assumes a uniform moisture distribution which is recognized as an approximation.

For maximum heat economy the thickness of the moist cake on the drum should not be allowed to drop below the critical thickness. The total cake thickness should be such that the sensible heat in the hot dry portion is sufficient to dry the moist portion to the desired extent, when the moist and dry portions are mixed. Therefore, in filter-dryer calculations it is necessary to predict the critical moist-cake thickness.

The critical moist-cake thickness can be predicted from the equations for the theoretical relationships for fluid flow and for drying:

#### FLUID FLOW RELATIONSHIPS

 $S_r = 0.0126 (K \Delta P/g \gamma \cos \theta)^{-0.504}$  $_{*} = F_t (K \Delta P/\mu L)$  See last month's article for discussion.

 $R = F_t \left( D_P K \Delta P / \mu^2 L X^n \right)$ 

L. E. Brownell is assistant professor of chemical and metallurgical engineering at the Engineering Research Institute, University of Michigan, H. E. Croster is a research fellow at the same institute.

#### DRYING RELATIONSHIPS

$$\begin{split} E &= 1 - e^{YW} \\ Y &= 1.44 \; (R)^{0.365} \; (1/D_{\rm Snohes})^{0.36} \; (W)^{-0.36} \\ & (\mathrm{See} \; \mathrm{Ref.} \; 1) \end{split}$$

#### RELATIONSHIPS BY DEFINITION

 $E_o = \text{drying efficiency at break} = 0.90$ (by arbitrary definition)

W. = moisture content of cake before drying,  $lbe/ft^2 = S_r X L_\rho$  (by arbitrary definition)

L, = critical most-cake thickness. inches =  $L(W_a/W_a)$ 

The moisture content (W) may be converted to an equivalent cake thickness (L) through the relationship for residual saturation (S.) and the Revnolds number (R) may be defined by the Darcy equation with a correction factor (F1) for turbulence. Combining these relationships by algebraic manipulation, the critical moist cake thickness  $(L_e)$  can be expressed in terms of permeability (K), pressure gradient (\Delta P/L), and correction for turbulence (F<sub>r</sub>). Using the properties of water at 130 deg. F. for the liquid, the properties of saturated air at 170 deg. F., and 27.92 in. Hg absolute pressure, 0.40 for the porosity (X), and 8 and 4 for the exponents (n) and (m), respectively, this relationship is expressed as follows:

$$L_a = 0.180 [K^{0.000}/(F_c)^{0.324} (\Delta P/L)^{0.022}]$$
 (1)

Fig. 1 is a plot of Eq. (1) and is convenient for predicting the critical moist-cake thickness.

For moist cakes of crystalline or granular particles in which the drying occurs from a free-liquid film surrounding each particle, the moist cake remains at the wet-bulb temperature of the air, virtually the adibatic saturation temperature. The wet-bulb temperature remains constant during drying for constant inlet-air temperature and humidity.

The temperature of the dry portion of the cake varies from the temperature of the moist portion to that of the entering air. This results from the combined heat and mass transfer which takes place during drving. The following mechanism is believed to exist. As the zone of vaporization progresses into the cake, it is followed by a zone of heat transfer in which there is a sharp temperature gradient. At the boundary between these two zones, the cake is at the wet-bulb temperature of the air. At and beyond the outer boundary of the heat-transfer zone, the cake is at the enteringair temperature.

In order to simplify the calculations, two temperatures have been assigned to the cake being dried, one for the moist fraction and one for the dry fraction. The moist fraction is assumed to be at the wet-bulb temperature of the air. The dry fraction is assumed to be at a temperature between the wet-bulb and enteringair temperature. The average temperature of the dry fraction is known to vary with conditions, and its accurate evaluation is a problem in unsteadystate heat transfer. However, the empirical relation given by Eq. (2) is based on limited data and is recom-



- = Specific heat of air, Btu./lb. der. F.
- Filtration constant for a given alurry, lb. sec./ft.4 (See Eq. 2, last month's article).
- = Specific heat of dry product, Btu./lb. deg. F. =  $\mu_L XL^2/K \Delta P$
- $= XL (\mu_L/\mu_a)$
- = Specific heat of moisture, Btu./lb.  $C_{ut}$ deg. F.
- Cubic feet per minute. cfm = Drying efficiency, dimensionless R(see Ref. 1).
- $E_{4*2}$ = Over-all drying efficiency. Average absolute pressure in cake/inlet absolute pressure to blower
- $(F_i)_1$ - Turbulence correction factor in moist cake fraction.
- = Humidity, lb. water/lb. dry air. = Permeability, ft.1/sec.1 K
- = Total cake thickness, in. =  $L_1 + L_2$ = Final moist cake thickness on L
- drum, in. - Average moist cake thickness on  $L_{1-avg*}$ drum, in. =  $(L + L_1)/2$ .
- = Final dry cake thickness on drum, La
- Lawry' = Average dry cake thickness on drum, in. =  $L_1/2$ . = Critical moist cake thickness, in.
- = Exponents depending on porosity 21. 100 and sphericity (see Ref. 2). Lbs. dry product/hr. AP
- Total pressure drop across the cake, lbs./ft.<sup>2</sup>  $\Delta P_{1-arg.}$  = Average pressure drop acre
- moist portion of cake, lbs./ft.<sup>2</sup>  $(\Delta P/L)_{t} = (\Delta P/L)_{t-acg.} = \text{pressure gradient}$ in moist portion of cake, lbs./ft.<sup>2</sup> (ft.) or in. Hg/in.
- Pressure gradient in dry portion of cake, lbs./ft.3 (ft.) or in. Hg/in.  $(\Delta P/L)_3 =$ Weight fraction of solids in slurry,
  - lbs. solid/lb. slurry. Saturation = volume of voids filled with wetting liquid/total volume voids.
  - = Residual saturation = maximum volume of wetting fluid eliminated from flow/total volume voids.
    - = Time, sec. = Necessary time to deposit the cake, sec.
- 7. - Temperature of the cake entering the drying zone, deg. F.
- $T_1$ Temperature of moist cake = wet bulb temperature of air, deg. F.

  = Average temperature of dry cake  $T_2$
- on drum, deg. F = Temperature of the air entering  $T_a$
- the filter cake, deg. F.
  Temperature of the air leaving T.
- the cake, deg. F.  $T_{\rho}$
- Average temperature of final exit product (mixed), deg. F.

  Wet bulb temperature of the pre-T ... heated air, deg. F.

  = Accumulative volume of air ft.3/
- Moisture content of moist cake to
- be removed by drying, lbs. moisture/lb. dry cake. W.
- Air flow through cake in drying zone, lb. dry air/min.
   Porosity of dry product, volum e X voids/volume cake.
- = Latent heat of vaporization of An water at T<sub>1</sub>, Btu./lb.
  Density of filtrate, lbs./ft.<sup>3</sup>

10.0

 Density of solid particles, lbs./ft.\*
 Viscosity of air, lbs./ft.-sec. = Viscosity of filtrate, lbs. /ft.-sec.

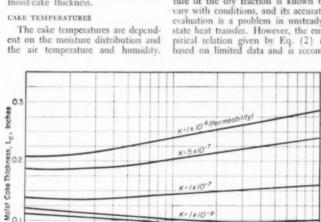


Fig. 1-Plot of Eq. (1) and is used to predict critical moist cake thickness from permeability, pressure gradient and (with last month's Fig. 4) turbulence.

Pressure Gradient, & P/L, In. Hg per In. Cake

0

Critical

mended for the approximate evaluation of the average dry-cake temperature  $(T_0)$ :

$$T_2 = T_a - 0.2 (T_a - T_{wb})$$
 (2)

#### AIR TEMPERATURE

The hot air supplied to the filterdryer loses some heat by radiation and convection. Data on commercial installations indicate that the heat loss for air at 900 deg. F. is about 50 deg. F.; for 600 deg. F. air, 30 deg. F.; and for 300 deg. F. air, 15 deg. F.

The air remains at virtually the inlet temperature while it passes through the hot, dry portion of the cake. It gives up heat in the heattransfer and vaporization zones, and leaves at a temperature somewhat above the adiabatic saturation temperature. For a selected over-all drying efficiency the temperature of the air leaving the cake  $(T_e)$  is given by Eq. (3) (based upon the definition of drying efficiency):

$$T_s = T_a - E_{avg.} (T_a - T_{ob})$$
 (3)

If the moist-cake thickness is kept above the critical value  $(L_e)$ , over-all drying efficiencies  $(E_{a+g})$  of about 0.95 may be expected.

In almost all filter-dryer installations the temperature of the air leaving the trunnion is close to the wet-bulb temperature.

#### ENTHALPY BALANCES

Enthalpy Balance to Determine the Thickness of the Moist Portion of the Cake Leaving the Drum:

If a completely dry product is desired, the final temperature of the product leaving the filter-dryer should be fairly close to the boiling point of the wash liquid. For partially dried products, the temperature will be lower in propertion to the desired moisture content.

By an enthalpy balance in which the loss of sensible heat of the cake is equated to the quantity of moisture

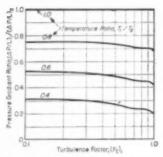


Fig. 2-Gives ratio of pressure gradients in moist and dry portions of cake.

vaporized, it is possible to determine the moist fraction of the cake leaving the drum. Assuming no heat losses and complete vaporization of liquid in the moist fraction of the cake, the balance takes the form of Eq. (4), based on unit area of cake and the moist-cake temperature as the reference.

Sensible heat in dry cake = sensible heat in product + heat of vaporization of the liquid in the cake.

$$L_{1}\left\langle C_{p}\right\rangle \left\langle T_{1}-T_{1}\right\rangle =L\left\langle C_{p}\right\rangle \left\langle T_{p}-T_{1}\right\rangle +\lim_{l}\lambda_{l}L_{l}$$
 (4)

Eq. (4) may be used to calculate the final moist-cake thickness  $(L_1)$ . The value of  $L_1$  should be kept above the critical moist-cake thickness  $(L_e)$ for economical operation.

Enthalpy Balance to Determine the Air Flow Required:

A second heat balance, this time between the entering air and the moisture vaporized from the filter cake, permits the calculation of the air requirements. This balance is shown by Eq. (5), below, and expressed in words as follows: Heat from the air to the cake (per minute) = Lb. of cake per minute × the sum of: sensible heat to bring the wet cake to the wet-bulb temperature + latent heat of vaporization for liquid evaporated at wet-bulb temperature + sensible heat to the dry portion of the cake.

$$W_a E_c (T_a - T_{wb}) (C_a) = (p/60)$$
  
 $[(C_c + w_i C_{wb}) (T_{wb} - T_e) + w_i (L_l/L)]$   
 $\lambda_i + (L_l/L) (C_p) (T_l - T_{wb})]$ 

In solving Eqs. (4) and (5), it is necessary to know the moisture vaporized from the cake (w,). This moisture is slightly greater than the residual saturation (S.) of the cake, as the time in the dewatering and drying zones is not sufficient to reduce the liquid in the cake to the equilibrium value of S.. However, the approach to the residual saturation is so close that (S. + 0.01) is recommended as an approximation. This value may be checked by calculating the final saturation (S) after the pressure drop  $(\Delta P)$  has been established. The moisture content to be vaporized (w,) can be calculated from this approximation of S as

$$w_t = [S_t + 0.01][X/(1 - X)][\mu/\mu]$$
 (6)

#### CALCULATION OF PRESSURE DROP

During drying the pressure gradients will not be the same in the moist and dry portions of the cake because of the differences in the air temperatures, viscosities, and densities. However, the mass rate of flow is the same in both portions and is equal to the air flow (W<sub>\*</sub>) calculated by Eq. (5).

It is possible to calculate the pressure gradient in the moist fraction by the methods given in last month's article, using the average thickness of the moist layer and the previously determined air rate. The rate of drying is uniform if the moist cake thickness remains greater than the critical, so that the average thickness of the moist layer may be taken as the arithmetic mean of the initial and final thicknesses of the moist layer.

The resistance to flow in the dry portion differs from that in the moist portion because of viscosity and density differences of the air. Since the viscosities and densities are expressible as functions of temperature, the Reynolds numbers of the air in the two portions of filter cake may be related by their temperatures, the other variables being constant. From the Reynolds numbers the corresponding friction factors may be evaluated and the pressure gradients may be calculated.

For convenience, these calculations are presented in Fig. 2, which gives the relationship between the pressure gradients in the moist and dry portions of the cake as a function of the turbulence factor  $(F_t)$ , and the ratio of air temperatures in the two portions. The turbulence factor  $(F_t)$  may be obtained from Fig. 4 of last month's article. The inflections of the curves in Fig. 2 are the result of transition from laminar to turbulent

Using the pressure gradient in the moist fraction, the ratio of the pressure gradients, and the average thicknesses of both portions, the total pressure drop  $(\Delta P)$  may be calculated by Eq. (7).

$$\Delta P = [(L + L_1)/2] (\Delta P/L_1) + (L_2/2) (\Delta P/L)_1 [(\Delta P/L)_2] (\Delta P/L)_1$$
((2)

#### VACUUM PUMP CAPACITY

The air required for drying, (Wa) is essentially the air passing to the vacuum pump. However, for more rigorous calculations, the water evaporated and the air flow during cake deposition, first dewatering, washing, and second dewatering should be added to the preheated air (W.). For practical purposes the air flow during cake deposition can be neglected. The air flow during dewatering and washing is small compared to that during drying, and is usually about 10 to 20 percent of the total. The air flow during these periods may be calculated by the methods in the previous ar-

#### EXAMPLE CALCULATION

The following problem is included to show the method of calculation.

Washed, wet, foundry sand is to be dried on a rotary-drum filter-dryer. For the given conditions, calculate the exhauster capacity and the heat requirements.

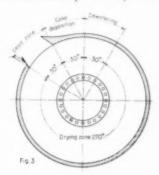
Tabulation of Results:-

Gas Rate (600 Btu./ft.\*, 535 Btu./ft.\* net), cfm

|                                  | Commercial<br>Installation<br>for Con-<br>ditions Given | Calcu-<br>lated |  |
|----------------------------------|---|-----------------|--|
| Vacuum, in. Hg<br>Air Flow, cfm. | 354-4<br>3,116  | 4.10<br>3,190   |  |
| Heat Descriptores                |   |                 |  |

37.3

Operating Conditions Selected:— Product is 5.2 tons per hr. of dry foundry sand. Air temperature from preheater is 630 deg. F. Feed temperature is 60 deg. F. Feed composition is 0.20 lb. sand per lb. slurry. Filter



area is 25 sq. ft. Cycle time is 99 sec. per revolution. Cycle is shown in this drawing; room temperature air is used during deposition and dewatering, preheated air for drying.

Final moisture content in product is 0.00 percent. Final average temperature of dry product is 180 deg. F.

Approximations:— (1) Air undergoes a 30 deg. F. radiation and convection loss between the preheater and the filter.  $T_a = 630 - 30 = 600$ deg. F. (2) Air enters the preheater at 70 deg. F. at relative humidity 60 percent, and humidity 0.009. (3) Air preheater is direct-contact type (i.e., products of combustion mix with the entering air). However, the mixture has essentially the same properties as air. (4) Wet-bulb temperature of the preheated air is 130 deg. F. (5) Average drying efficiency equals 95 percent, i.e.,  $E_e = 0.95 = (T_e - T_e)/(T_e - T_e) = (600 - T_e)/(600 - 130)$ . From this  $T_e = 154$  deg. F. (6) All moisture below a saturation of (S, + 0.01) must be vaporized in the drying zone. (7) Average temperature of dry

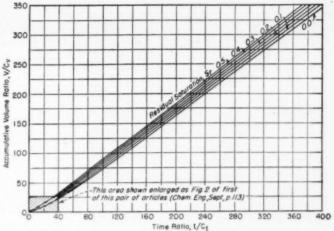


Fig. 4—Integrated air-rate curve (high range) showing the air flow V as a function of the filtration constant  $C_s$ , time ratio  $t/C_s$  and residual saturation  $S_s$ .

portion of cake on the drum is:  $T_e = T_a - 0.2 (T_a - T_{vb}) = 600 - 0.2 (600 - 130) = 506 \text{ deg. F.}$ 

Filter Cake Data:—Density of sand particles,  $\varepsilon'=165$  lb./ft.º Porosity of drv saud, X=0.40 (estimated). Residual saturation,  $S_r=0.238$  (from experimental data). Average permeability,  $K=2.46 \times 10^{-6}$  (from experimental data). Heat capacity of sand,  $C_0=0.20$  Btu/deg. F. lb. dry sand. Solids in slurry, s=0.20 lb. sand/lb. slurry.

Air Properties:—(1) Dewatering Zone: dry-bulb temperature = 70 deg. F.; wet-bulb temperature = 60 deg. F.: viscosity, 14., at wet-bulb temperature = 0.0176 c.p. (2) Drying Zone: temperature leaving moist cake, T. = 177 deg. F.; viscosity, 4., at 154 deg. F. = 0.0197 c.p. (3) Filtrate (Water): viscosity in cake deposition and dewatering zones (60 deg. F.) is 1.13 c.p.; viscosity in drying zone (130 deg. F.) is 0.512 c.p.; vapor pressure of water (130 deg. F.) is 4.525 in. Hg: density in cake deposition and dewatering zones is 62.4 lb./ft.\*; density in drying zone (130 deg. F.) is 61.5 lb./ft.º

#### Calculations:

(1) Actual Thickness of Deposited Cake: thickness,  $L = [(5.2 \times 2,000)/3,600] \times 99 \times [12/165 (1-0.4)25] = 1.385$  inches.

(2) Moist Fraction of Cake Leaving Drum (Basis: Unit area of cake and moist cake temperature as the reference): First,  $S = (S_r + 0.01) = (0.238 + 0.01) = 0.248$ ; substituting in Eq. (6),  $w_1 = 0.248$  [0.40/(1-

0.40)] [61.5/165] = 0.0616; and putting this in Eq. (4),  $(1.385 - L_1)$  (0.20)(506 - 130) = (1.385)(0.20) (180 - 130) + (0.0616)(1.025.8)  $(L_1)$  from which  $L_1 = 0.625$  inch, and  $L_2 = L - L_1 = 1.385 - 0.652 = 0.733$  inch.

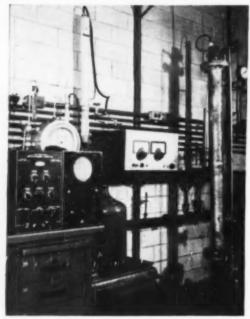
(3) Check of Final Moist Fraction Against Critical Moist-Cake Thickness: L, from Fig. 1 (at K = 2.46 × 10<sup>-α</sup> and (ΔP/L) from 1 to 10 in. Hg/in. cake) is about 0.110 in., which is less than the final L<sub>1</sub>. Therefore an average efficiency of 90 percent is valid.

 $L_{1-avg.} = \frac{1}{4} (L + L_1) = \frac{1}{4} (1.385 + 0.652) = 1.018 in_{\bullet}$ 

 $L_{3-avo} = L_2/L = \frac{1}{4}(0.733) = 0.367$  in.

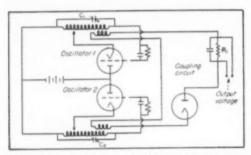
(4) Air Flow in Drying Zone: Substituting known values in Eq. (5),  $W_o = [10,400/60] [(0.20 + 0.0616 \times 1) (130 - 60) + (0.0616) (0.733/1.385) (1.025.8) + (0.733/1.385) (0.20) (506 - 130)]/[(0.90) (600 - 130) (0.24 + 0.060 \times 0.45)] = 140.2 lb. dry air per min. (Using H of air out = H of air saturated at 130 deg. F., one atmosphere = 0.1105 lb. H<sub>2</sub>0/lb. dry air. H of air in = 0.009 lb. H<sub>2</sub>0/lb. dry air. <math>H_{avg} = 0.060$  lb. H<sub>2</sub>0/lb. dry air.

(5) Calculation of Pressure Gradients: Assuming average vacuum in moist zone = 3 in. Hg: V =  $[(140.2/60) (99) (1.060)] [359/(29 + 0.60 \times 18) (1/1.06)] [(460 + 177)/492] [29.92/2692]/[25(270°/360°)] = 237 ft.*/ft.*cycle. Substituting in Eq. (15) of last month's article, <math>C_r = XL_{t-arr} (\mu_t/\mu_a) = (0.40) (1.027/12) (0.512/0.0197) = (Continued on page 170)$ 



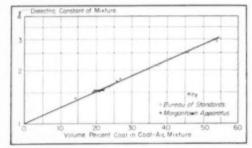
Coal charging hopper Fluidization chamber Fluidized coal bed-Wet test meter Entrance funne Fritted glass plate Direct Oscillator current amplifier Oscilloscope Voltage regulated power supply

APPARATUS in which the weight-ratio experiments were made. DIAGRAM of the apparatus and associated electronic circuit.

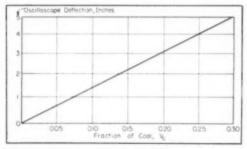


# 00 copper tubing Side View

CIRCUIT (simplified) for measuring change in dielectric constant. CONDENSER through which the coal-air mixture was passed.



PROOF that the dielectric constant varies with composition.



CALIBRATION relates oscilloscope reading and coal volume.

## **New Method Measures the**

## Solid:Gas Ratio in High-Solid Flow

An electronic method has been developed for measuring the instantaneous solid:gas flow through a tube when the solid is about 20 percent by volume. It detects a change of about 1 percent solids by volume.

#### J. M. DOTSON, J. H. HOLDEN, C. B. SEIBERT, H. P. SIMONS and L. D. SCHMIDT

In our studies on the flow of extremely dense coal-air mixtures (about 200 lb. of coal per lb. of conveying air) we needed a method of measuring the instantaneous ratio of coal to air. The purpose of our studies was to assure a constant rate of coal feed to a reactor in which the coal is gasified with steam and oxygen. Residence time of the coal in the gasifier is only about a second. It is therefore important to keep the ratio of coal to gasifying agent constant.

An electronic instrument was developed for measuring the coal:air ratio over short time intervals so that the steadiness of the coal flow could

be measured.

It should be useful in measuring the uniformity of mixing of any pulverized solid and gas provided the concentration of the solid is high enough to make the dielectric constant of the mixture measurably higher than that of the gas alone.

Our new instrument does not measure the rate of coal flow; it measures the homogeneity of the flowing mixture of coal and air. Since the mixture flows as a fluid, its rate will be constant (1) if the pressure drop causing the flow is constant, (2) if the mixture is homogeneous. The instrument was designed to have a high speed of response so that measurements over short time intervals could be made and so that it could give a picture of the variations in the coal:air ratio. This allows us to evaluate the various methods of improving the homogeneity of the mixture.

The method measures the change in dielectric constant of the coal-air mixture as it flows between the plates of a condenser. Measurement of an electrical property has the advantage of a high speed of response; those with mechanical movements of the measuring device are much slower. By using an oscilloscope as the recorder, there is no time lag and the variation of the measurement with time is recorded.

The change of the dielectric constant of a mixture of dust in gas over that of the gas alone has been suggested as one way to measure the dust concentration. In previous cases it was found inapplicable because the capac-

itance change caused by the presence of the small amount of dust (as a fraction of the total volume) was too low to measure. The change in dielectric constant from all-air to 20 percent coal and 80 percent air by volume is about 0.5 mmfd. (corresponding to a 40 percent change in the effective capacity of a condenser). This change is large enough to be measured in the condenser used.

#### HOW THE CIRCUIT WORKS

Measurement of capacity requires an oscillating circuit; several of these have been described. The circuit used in our instrument was adapted from one described by Potter. It uses two synchronized oscillating circuits that are coupled inductively.

A simplified circuit diagram is shown (p. 128). \*When oscillators 1 and 2 have the same frequency and phase, no current flows in the inductively coupled circuit. The latter is shown beside the oscillating circuits. If the capacity of C, (which is in the circuit of oscillator 1) is changed, the two oscillators are no longer in phase. A current then induced in the coupling circuit is proportional to the phase difference. It is therefore a measure of the change in capacity of condenser C. The high-frequency current in the

A cooperative development of the Bureau of Mines and West Virginia University. J. M. DOTSON was a student in chemical engineering at West Virginia University where C. B. SEIBERT is associate professor of electrical engineering and H. P. SIMONS is professor of chemical engineering. J. H. HOLDEN is a chemical engineer with the Synthesis Gas Production Branch of the Bureau of Mines' Office of Synthetic Liquid Fuels; L. D. SCHMIDT is chief of the Branch. All are at Morgantown,

A complete circuit diagram can be obtained from the U. S. Bureau of Mines, Morgantown, W. Va.



Oscilloscope readings-inches deflection above the datum line-are converted into volumetric fraction of coal in the mixture to check homogeneity.

coupling circuit is rectified by the diode. Voltage drop across a resistor (R1) is used to measure this current.

Information from Potter' on his circuit indicated that a voltago drop of 30 m.v. could be obtained across 1,000 ohms resistance from a capacitance change of 0.02 mmfd. (or a change of about 1 percent in the volume of coal). Since this voltage change was to be measured by a vertical deflection on an oscilloscope, an amplifier was necessary to get a measurable deflection of about 0.1 in. for a 1 percent change by volume in the coal-air mixture. The measured capacitance change was small; it is therefore necessary to have a constant line voltage.

#### THREE-UNIT CIRCUIT

The complete circuit has three units: (1) A power-supply unit which gives a constant voltage input for the oscillators and the amplifier, (2) the oscillators and the coupling circuit which measure the capacity change, and (3) a direct-current amplifier for the voltage input to the oscilloscope. The frequency of the oscillator circuits is 1.5 megacycles. The condenser (Cas not shown) through which the coalair mixture flows is in parallel with C1. Condensers C, and C, were used to calibrate the apparatus since a change in C, is equivalent to a change in C, The voltage drop in the coupling circuit is measured.

Coal condensers (see cut) were made of aluminum plates separated by Bakelite strips. The passage through which the coal-air mixture flows is about 0.1 in. square in cross-section by 7 in. long. Capacity of the effective part of this condenser was calculated to be 1.176 mmfd, when it contained

Amplified and unamplified voltages were measured with a voltmeter as C was varied over the range to be used

in measuring the coal:air ratio. The amplified and unamplified voltage outputs and the deflection in inches on the oscilloscope were found to vary linearly with the capacitance change of the condenser. The capacitance change of condensers C, and C, was measured with a radio-frequency bridge and found to be linear over the range used. The value of C, was found by calibration to be 0.0283 mmfd. per division.

#### CALIBRATION WITH COAL

A coal-air mixture was blown through the condenser from a pneumatic feeder developed by the U. S. Bureau of Mines at Morgantown, W. Va., for feeding coal to a reactor. The feeder operates by (1) forming a fluidized bed of coal under pressure. (2) bleeding off most of the fluidizing air from the top of the container, and (3) causing the coal-air mixture to flow from the bed through a coaldelivery tube to the point of use. Around the enfrance to the coal delivery tube is a shield that gives a bed of uniform density by partial settling of the coal. Coal flows from the tube through the condenser in the oscillating circuit. The output voltage, which is recorded on the oscilloscope. measures the coal:air ratio in the tube. At the rates of flow used in the experiments, any coal particle was in the condenser between 0.05 and 0.1 sec.

The dielectric constant of a mixture of finely divided solid randomly spaced in a gas has been reported to follow the equation:  $\log \hat{D}_m = V$ ,  $\log D$ , where Dm is the dielectric constant of the solid-gas mixture; V, is the volumetric fraction of solid in the mixture; and D is the dielectric constant of the solid. To test if this relation would apply to coal-air mixtures, we made simultaneous measurements of the coal:air ratio and the deflection on the oscilloscope. The coal-air mixture from the feeder was passed through the condenser and the average deflection on the oscilloscope determined. The coal was then caught and weighed in a container; the conveying air was measured by a wet test meter.

The test data are shown. The logarithm of the dielectric constant of the mixture has been plotted against the volumetric percent of coal in the mixture. The experimental data are marked with dots. Points marked with circles are determinations made on a sample of the coal by the National Bureau of Standards through the courtesy of Charles Moon. The logarithmic relation is shown to hold for the coal used in these experiments.

\* Chief. Inductance & Capacitance Section, Division of Electricity & Optica.

This coal has a density of 86.7 lb. per cu. ft. and a screen analysis of 89.1 percent through a 200-mesh Tyler Standard. It has 0.9 percent moisture.

Also shown is a plot of the deflection on the oscilloscope against the volumetric fraction of coal in the mixture passing through the condenser.

#### USE OF THE INSTRUMENT

The instrument was used to determine the effect of a shield around the feed inlet on the coal:air ratio of the mixture flowing through the coal delivery tube from the pneumatic feeder already described.\* The time required for the spot to move across the field of the oscilloscope was in all cases 1 second.

The volumetric fraction of coal in the mixture is found from the distance of the spot above a datum line. The shield effects uniformity of the mixture flowing through the tube.

Use of the instrument is restricted to solid:gas ratios that are high enough to cause a measurable change in the capacity of the condenser. Greater sensitivity can be gotten by increasing (1) the length of the condenser, (2) the amplification ratio or (3) decreasing the inductive coupling between the oscillators. However, in the last two cases, errors are also multiplied; and extreme care would be necessary to eliminate the effects of changes in line voltage and temperature changes. The effective range of solid concentrations is above about 5 percent by volume when the solid has a dielectric constant similar to that of coal. This minimum effective range may be lowered by using a solid such as titanium dioxide, which has a di-electric constant of 80 (about 10 times that of coal).

The probable minimum variation in a high dielectric constant material that could be detected is about 0.1 percent solid by volume. At high solid concentrations, however, the instrument has proved to be very effective in measuring changes in the solid:gas

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## The Plant Notekook

THEODORE R. OLIVE, Associate Editor

Chart A- Evaporation Factor Evap discharge Baums at operating temp 24 25 26 27 28 29 3 Feed liquor Evap. factor, Ib. H<sub>2</sub>O evap. /Ib. feed 0.66 Chart B-Water Evaporation Evap factor, lb. H<sub>2</sub>O evap./lb. feed 0.63 0.64 0.65 0.66 0.67 0.68 Evaporator feed. Thousands of lb. water evap. per hour 520 180 Chart G-Evaporator Economy Thousands of the of steam used per hour 34 35 36 37 38 39 1,000 lb 34 35 36 37 38 39 namy, lb. H<sub>2</sub>O evap/lb. steam used 180 50

#### Three Simple Charts Aid Economy Calculations for Evaporators

MURRY L. OLIVER, Research Chemist, Hopewell, Va. \*August Contest Prize Winner

In the operation of evaporators it is frequently necessary to calculate the evaporator economy. The economy of an evaporator may be measured by the number of pounds of water evaporated per pound of steam supplied. This calculation usually requires the service of a chemist or engineer. By the use of three charts it is possible for anyone operating an evaporator to compute the economy within 2 min.

Almost all evaporator operators record hourly on a log sheet the important data necessary for operation; namely, the thousands of pounds of steam used per hour, gallons per minute of feed liquor flow, and hydrometer readings of the feed and discharge liquors. From these facts the operator can compute hourly the evaporator economy by the use of three charts, A, B, and C, which are skeletonized above for illustration.

In Chart A it is necessary to establish curves of density (Baumé) versus percent solids of the evaporator feed and discharge liquors at temperatures as used in operation. The Baumé reading will then represent definite percent solids. The feed liquor is tested with a Baumé hydrometer marked in tenths, and the discharge liquor with a hydrometer marked in whole numbers. For illustrative purpose, assume that the feed liquor of 7.5 deg. Bé. at the temperature of operation contains 15.6 percent solids, and that the discharge liquor of 26 deg. Bé. at the temperature of operation contains 46.0 percent solids. Applying these percentages to the evaporation factor formula

percent solids in feed liquor

percent solids in discharge liquor

will give 0.66 lb. of water evaporated per pound of evapo-

rator feed liquor. In Chart  $\vec{B}$  it is necessary to take an average density

of the feed liquor and apply this density to the various gallons-per-minute feed liquor flow rates. To illustrate the chart, assume 8.8 lb. per gal. The gallons per-minute feed liquor flow rate, multiplied by the density times 60, will give the pounds of feed liquor per hour to the evaporator. The pounds of feed liquor per hour multiplied by the evaporation factor (from Chart A) will give the pounds of water evaporated per hour by the evaporators. The pounds of water evaporated per hour is expressed in thousands of pounds, and to the nearest five-thousand digit.

In Chart C the thousands of pounds of water evaporated per hour, divided by the thousands of pounds of steam used per hour, will give the over-all evaporator economy. The economy is computed to the nearest tenth.

To illustrate how to use the charts, consider this example:

Let the evaporator feed liquor = 7.5 deg. Bé. at the temperature of operation; the evaporator discharge = 26 deg. Bé. at the temperature of operation; the feed liquor flow rate = 520 gpm; and the steam usage = 36,000 lb. per hr.

The feed and discharge Baumés applied to Chart A will give the evaporation factor of 0.66. The evaporation factor of 0.66 and the evaporator feed flow of 520 gal. per minute applied to Chart B will give 180,000 lb. of water evaporated per hour by the evaporator. The 180,-

★ SEPTEMBER PRIZE WINNER-A \$50 prize will be issued to

WALTER G. THOMSON Minneapolis, Minn.

for an article describing a method of building a pilot light for high velocity combustion processes which cannot be blown out under any conditions. This article has been judged the winner of our September contest. It will appear in the November Plant Notebook.

\$50 PRIZE FOR A GOOD IDEA-Until further notice the Editors of Chemical Engineering, will award \$50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook.

The winner each month will be announced in the issue of the next month, e.g., the September winner will be announced in October and his article published in November. Judges will be the Editors of Chemical Engineering. Nonwinning articles submitted for this contest will be published if acceptable at usual space rates.

HOW TO ENTER CONTEST-Any reader of Chemical Engineering, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Articles may deal with any sort of plant or production "kink" or short-cut that will be of interest to chemical engineers or others in the process industries.

Also, novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address Plant Notebook Editor, Chemical Engineering, 330 West 42nd St., New York 18, N. Y.

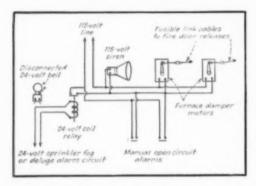
 $000~\rm{lb}.$  of water evaporated per hour and the 36,000 lb. of steam usage per hour applied to Chart C will give 5.0

as the over-all evaporator economy.

Anyone desiring to construct Charts A, B, and C should establish curves of density versus percent solids of the evaporator feed and discharge liquors at temperatures as used in operation. The density of most evaporator feeds will vary within 1 or 2 deg. Bé. Therefore, in most evaporator operation an average density can be used without introducing a serious error.

This short-cut method of computing the economy should be of considerable value to the operators as a

guide to evaporator performance.



#### How Fire Safety System Was Improved at Small Expense

JAMES SMITH, Plant Engineer, Sinclair & Valentine Co., Chicago, Ill.

In one section of our plant which manufactures printing inks and allied materials containing flammable solvents, a fire alarm system had been developed using a small bell, connected to a flow switch on the deluge sprinkler system. This bell could be heard only with difficulty in the plant proper. It was also impossible to notify workers in other sections of the plant if emergency help was needed in case of fire.

To eliminate this condition, the 24-volt bell was disconnected and a 24-volt relay was connected in its place to operate a 115-volt siren. In addition, several manual alarm buttons were installed, which workmen could use to obtain

help before the sprinkler system took effect.

As a method of scaling fires within the area involved the fire doors were balanced with weights, through a bimetal link, which would fuse and close the doors automatically. This is the usual method of operating such fire doors. To improve this method of operation I designed a system which allows these doors to be released through a simple furnace damper motor, as illustrated in the accompanying diagram. Thus the sprinkler and siren alarm described above activate the door release before the fusible links have a chance to melt. This can come about either through action of the flow switch in the sprinkler system, or thorough manual operation of one of the alarm buttoms.

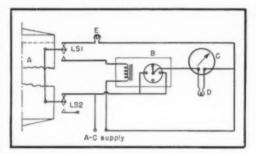
In either event it is now possible for the fire doors to be closed much sooner than by the old system, thus adding a wide margin to their usefulness as safety factors. The new arrangement requires only that the cable containing the fusible link be slipped over the operating lever of the damper motor so that it will slip off and release the door

when the motor operates.



#### Novel Hoods Remove Dust From Filling Machines

Gilliam Packaging Co., of Cleveland, which mixes and packages chemicals for industrial use, has an unusual appearing installation of hoods to pick up the dust produced by a variety of packaging machines. The machines are ventilated by an in-draft of air into the bottoms of the hoods, produced by an exhaust fan discharging to a Sly dust filter. Hoppers above, from which the filling machines are charged, are also hooded on three sides and the top. At the extreme right is a hood extending around one side of the discharge gate of a bag filling machine, picking up float dust by the cross draft.



#### Automatic Indicator Cheeks Feed Pump Operation

D. J. Breeze, Plant Development Dept., Monsanto Chemicals Ltd., Ruabon, Wales.

In the February 1949 Plant Notebook, G. A. Coleman described a calibrating system for variable-volume chemical feeders, permitting easy routine checking. Readers may be interested in a different method of accomplishing this job which has been worked out by our instrument department.

In the sketch, A is a head tank, charged batchwise, which feeds to either of two metering pumps. The circuit and instruments in the sketch indicate to an operator supervising the main control panel how long the metering pump takes to deliver a known volume of liquid. Incidently, at the same time they tell when the tank needs refilling, and when it has been filled to the correct level.

In the sketch, LS1 and LS2 are level switches. In the type used, the switch contacts are operated magnetically by a float, each float and switch assembly being a self-contained unit which screws into a boss on the side of the tank. The switches are suitably mounted on the tank so that one is just below the maximum liquid level, and the other just above the minimum level. Device B is a relay-operated selector switch with an even number of contacts. The "finger" moves forward one step each time the relay coil is energized. Unit C is an electric stop clock mounted on a control panel, while D and E are panel-mounted signal lamps.

Here is how the cycle operates:

1. The operator pumps liquid into the head tank A until the upper contacts of LS1 close, causing lamp E to light. The lower contacts of LS1 open. Contacts of LS2

are closed and the selector switch finger B is on the neutral contact.

2. The metering pump now lowers the tank level to LS1, when its upper contacts open. Lamp E goes out, the lower contacts of LS1 close, the relay coil is energized and the selector switch finger moves to the live contact, starting the stop clock.

3. The tank level reaches LS2, the contacts of which open. The relay coil is de-energized and the stop clock stops. Signal lamp D goes out, showing that the tank needs recharging. The operator notes the stop clock reading, which tells him whether the metering pump rate is correct, then resets the clock to zero.

4. The tank is refilled by the operator. As the level reaches LS2, the contacts of this switch close. Hence the relay coil is energized, the selector switch finger moves to the neutral contact; the clock is unaffected.

5. The tank level continues to rise to LS1, at which point the lower LS1 contacts open, while the upper contacts close. The cycle repeats.

To help the operator in checking the metering pump rate he is provided with a table which correlates clock time with pump delivery rate, based on previous calibration of tank A with water.



BEFORE: Manpower



Acctate Plant Develops Saw for Salvaging Heat Exchangers

Research and engineering skill have outmoded the troublesome, back-breaking job of sawing heat exchanger tubes at the acetate rayon plant of E. I. du Pont de Nemours & Co., at Waynesboro, Va.

Nemours & Co., at Waynesboro, Va.

Torches, manual hack saws, and crosscut saws, which
were formerly used in the reclaiming of shell and tube
and hairpin type heat exchangers, have been replaced by
a labor-saving power band saw.

The new device, which was built by the Wells Manufacturing Co. of Three Rivers, Mich., after extensive research and experimentation by Du Pont and Wells men, will saw 48-in. diameter tube bundles, 24-in. diameter



AFTER: Horsepower

stainless steel, and 12-in diameter copper bundles. The installation, which has been in use for about a year, has been virtually free of trouble.

Tube replacement is frequently necessary due to the corrosive nature of some of the process materials. Removal of the tubes in a manner which permits re-use of tube sheets and baffles has formerly been accomplished with manual hack saws and crosscut saws. When the latter were used, a three-man team formed a group. While two men sawed, a third man sharpened saws. Frequent changes of saws were necessary.

In some cases, tube bundles had to be cut with a torch, followed by sawing and facing in a lathe to secure a tube stub which could be driven from the tube sheet.

The Wells power band saw has been adopted in other Du Pont plants for reclaiming heat exchanger equipment. W. F. Lawless, works engineer at the Waynesboro plant, originated the idea of the power band saw and H. C. Moss, materials of construction consultant of Du Pont's Engineering Department, worked with the Wells Manufacturing Co. to perfect the device.

# Process Equipment News

THEODORE R. OLIVE, Associate Editor



Graduates show relative quantities of new (left) and old lubricants that can be stored in a plug valve.



Valve can be lubricated and re-lubricated as needed, either with stick lubricant or by a grease gun.

## Compressible Lubricant Makes Plug

Valve Lubrication Automatic

Nordstrom's new Hypermatic lubricant feeds under own pressure, making frequent servicing unnecessary

What is believed to be the first compressible fluid of liquid-like characteristics is the new valve lubricant, Hypermatic, just announced by Nordstrom. A development of George F. Scherer, company director of research, the new lubricant is described as the result of a 20-year search for a satisfactory method of producing automatic lubrication of plug type valves. Because it is com-

pressible (or "energizable" as the company describes it) Hypermatic can be injected into a valve, thereafter feeding automatically through its own pressure into the internal ducts and channels of the valve. When eventually the pressure becomes too low, it can be regenerated by turning the lubricant screw, or by adding more lubricant, either in stick form, or by

grease gun.

No added investment in equipment or attachments is needed to use the new lubricant which can be applied, it is estimated, in 75 percent of all the pressurized plug valves now in service. Depending on the service, the frequency of lubrication is said to be reduced to from 1 to perhaps 10 percent of the lubrications required with present materials. This means a large saving in servicing and maintenance expense while some saving in lubricant cost also can be expected owing to de-

crease in the likelihood of over-lubrication.

Although in use Hypermatic is always under pressure and flows readily through the lubricant channels, when spread in a thin film between the valve seating surfaces it resists displacement and thus is less likely to flow into the line at the time of lubrication than incompressible lubricants. By the same token, it is claimed to be particularly effective in stopping leakage within the valve. And because leakage involves a pressure drop along the leakage path, pressure of the lubricant can be less than line pressure to accomplish a seal.

To start the use of Hypermatic it is not necessary to remove the old lubricant, which gradually will be displaced. Automatic lubrication is said to be effective at all pressures (including vacuum) for which plug type

This Month . . .

To make sure you won't miss them, here are some of the high-lights of later pages . . . If your problem is measuring the thickness or unit weight of rapidly moving web material, such as coated fabrics or plastic films, the beta ray recording gage on p. 136 may be your answer.

Or if plug valve wear has been giving trouble, you will be interested in the valve with the split wearcompensating plug on p. 136. Do you know how the mathema-tician's "horn angle" is used to produce tremendous pressure in new roller press now being developed commercially for expressing liquids from solids, milling powders, breaking down fibrous materials for further processing? If not, then see p. 188 . . . Is infa-nitely variable speed control from zero up needed in one of your operations? You'll be interested in how a new a.c. system does the job without electronics. See p. 140,

#### Next Month . . .

We're working on a lot of interesting new ideas for your next month's fare. To select a few at random. a waterless gas holder without the usual seals or sliding parts...a new idea in chemical valves using a self-lubricating plastic seal to provide complete corrosion protection...a novelty in automatic electroplating. See you then?

valves are suitable. Because of its compressibility, from 50 to 100 percent more Hypermatic by volume can be introduced into a valve than present lubricants, as indicated by the quantities in the graduates shown in the view above.

Nordstrom Valve Div., Rockwell Mig. Co., 400 North Lexington Ave., Pittsburgh 8, Pa.

SMOKE CONSUMER:

Over-Fire Jet

To facilitate smoke control in boiler furnaces, the Eclipse Fuel Engineering Co. has developed an over-fire air jet system employing a centrifugal pressure blower as the source of air supply. When smoke is being produced it means that insufficient air is present

in the firebox to burn hydrocarbon vapors completely. By forcing air jets into the firebox above the flame, turbulence is created and combustion improved. Controls can be manual or automatic. If the latter is selected, a photoelectric cell is installed in the stack to start the blower automatically if the smoke density goes too high.

Eclipse Fuel Engineering Co., Rockford, Ill.



#### NON-CLOSSING:

#### **Unusual Spray Nozzle**

A unique spiral design, producing finer atomization, has been incorporated in a new line of nozzles for flow rates from 4 to 100 gpm. This new Bete nozzle shears a continuous film of liquid from a single high velocity jet so that it readily breaks up into uniformly fine particles at fairly low pressure. Vanes or whirling disks are not required. The principle can be adulted to various snray natterns.

adapted to various spray patterns.

The Bete Fog Nozzle Co., Greenfield, Mass.



LIGHT, DURABLE:
Plastic Drying Trays

Glastic, a Fiberglas-reinforced plastic made with Laminac polyester resin, is used in a newly offered line of chemical and pharmaceutical drying trays. These are light in weight, yet said to be extremely durable and resistant to denting and chipping. Temperatures up to 350 deg. F. have no effect over long periods and most solvents, practically all hydrocarbons, most moderate acids and alkalis, and all salts are without effect. The cost

is said to be less than many types currently being used. For identification, color can be incorporated into the resinous material if desired. Several sizes are now produced as standard, while other sizes can be developed at moderate cost.

Laminated Plastics, Inc., 14838 Euclid Ave., Cleveland 12, Ohio.



QUIET OPERATION: Positive Blower

Quietness of operation, compactness, and greatly reduced weight compared with similar blowers are important features claimed for the new Standardaire blower developed by Standard Stoker Co. Blowers of this type are produced in capacities from 100 to 15,000 cfm., for pressures up to 20 lb. The compression member consists of a pair of rotors of interesting design, one of symmetrical epicycloidal form which mates with a sec-

#### Marshall and Stevens Indexes of Comparative Equipment Costs

(1926 = 100)

Compiled quarterly for March, June, September and December of each year by Marshall and Stevens, evaluation engineers, Chicago and Loc Angeles, or expectation of the method of the second of the second of the method of obtaining the industries, from the second of the method of obtaining the industries listed here are selected. Published each month with the latest available revision. For a description of the method of obtaining the index numbers see R. W. Stevens, Chemical Engineering, Nov. 1947, pp. 124-6. For a listing of animal averages since 1913 see Chemical Engineering, Feb. 1949, p. 123.

|                    |       | w     |       |
|--------------------|-------|-------|-------|
|                    | Sept. | June  | Sept. |
| Industry           | 1948  | 1949  | 1949  |
| Average of all     | 166.5 | 160.6 | 159.6 |
| Process Industries |       |       |       |
| Cement mfg         | 160.5 | 155.9 | 155.9 |
| Chemical           | 168.5 | 163.3 | 163.4 |
| Clay products      | 155.5 | 150.9 | 150.4 |
| Glass mfg          | 158.6 | 154.0 | 153.5 |
| Paint mfg          | 161.8 | 157.2 | 156.7 |
| Paper mfg          | 162.1 | 157.5 | 157.0 |
| Petroleum ind      | 164.9 | 160.3 | 159.8 |
| Rubber ind         | 167.3 | 162.7 | 162.2 |
| Process ind. avg   | 165.9 | 161.4 | 160.4 |
| Related Industries |       |       |       |
| Elec. power equip  | 170.1 | 165.5 | 165.0 |
| Mining, milling    | 169.2 | 164.6 | 164.1 |
| Refrigerating      | 181.5 | 174.8 | 173.9 |
| Steam power        | 157.2 | 152.6 | 152.1 |

ond rotor which acts as a gate. Air is taken in and discharged smoothly from pockets which form between the rotors, with compression developing gradually and without shock within these pockets. The construction is said to make possible lowest possible blower weight for a given capacity, and a lower noise rating.

The blower operates at motor speed and thus requires no gearing other than the timing gears between the rotors. Larger blowers of the line, operating at efficient pressure-speed ratios, are able to develop over-all adiabatic efficiencies around 80 percent or slightly better.

The Standard Stoker Co., 370 Lexington Ave., New York 17, N. Y.



CONSTANT VOLUME: Flow Regulator

A new principle in constant volume flow regulation under varying pressure is incorporated in the recently announced Kates regulator. The device has only a single moving part and is said to hold any preset flow volume constant while the pressure upstream may vary over a range of 100 psig.

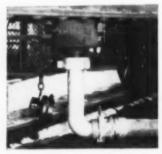
The regulating unit is contained in a vertical cylindrical case having in the upper portion a valve seat and disk, the opening of which is adjusted by a threaded valve stem calibrated linearly in gallons per minute flowing. Concentric with this valve is a differential pressure orifice and movable disk, coupled directly to a high-pressure valve in the lower part of the regulator. This combination produces a constant differential pressure and hence a constant flow which, however, can be regulated by varying the opening of the main valve. The only moving part of the entire regulator is the movable disk in the orifice and the high-pressure valve connected to it. This rigid assembly floats vertically, (Continued)

without restraint, except for the balancing forces of fluid pressure differ-

ential and gravity.

The regulator can be installed without special tools and is suitable for a wide variety of applications, including fuel lines, blending, backwash and rinse control, and a variety of chemical plant problems. Both large and small sizes are available.

The W. A. Kates Co., Deerfield,



CAR UNLOADING FITTING

Weighing under 10 lb., this cast aluminum unloading fitting for universal tank car use is said to ease handling and speed hook-up. Connection requires less than 1 min.

The fitting can be provided with various rapid couplings, and in other cast metals than aluminum. Mead Cornell & Co., P. O. Box 2682, Cleveland 7, Ohio,



TRANSMIT OR CONTROL: Pneumatic Instruments

Series A-SS covers a new line of pneumatic instruments for transmitting and controlling flow, pressure, liquid level, and specific gravity, just announced by American Meter. The designs are said to incorporate numerous features developed in cooperation with user instrument engineers, among others, maintenance and service simplifications resulting from reducing the number of pivot points and moving parts to a minimum. Parts are standardized and sub-assemblies unitized, with a high degree of interchangeability. Thus the new instruments are readily convertible to changing condi-tions and applications. These instruments use a relay which includes a damping device for smooth operation, equipped with a self-cleaning primary orifice and a bypass to permit ready change to automatic control. Reversing of the instruments is easily accomplished by shifting one end of one link, without disturbing other adjustments. A proportional reset controller-receiver, with recording, is shown in the accompanying view.

American Meter Co., 60 East 42nd St., New York 17, N. Y.



USES BETA RADIATION: Thickness Gage

Beta radiation from strontium-90 produced at Oak Ridge is being used in combination with a radiation detector for measuring continuously moving sheet materials without physical contact. Two models, designated as SM-2 and SM-3, are now being produced by Tracerlab. The sheet material to be measured is interposed between the source and the detector and a part of the radiation is absorbed by the sheet, in proportion to its weight per unit area. This weight per unit area, or the thickness, is then read on a properly calibrated recorder connected to the detector. For all practical purposes, chemical composition of the sheet being measured does not affect the calibration of the instrument. Thus, it is comparable to a balance which measures weight without regard to compo-

So far, instruments of this type have been used on condenser paper as thin as 0.0002 in., on metal sheets and foils, on coated textiles and plastic films, and on rubber sheets up to 3/16 in. thick. Inherent accuracy is — 0.05 percent of sample thickness.

or  $\pm$  0.03 mg. per sq.cm., whichever is larger. The first model mentioned, a heavy-duty type, employs a continuous recorder, while the lighter duty second model indicates thickness on an indicating meter.

Tracerlab, Inc., 130 High St., Boston 10, Mass.



ALLOY FILTER CLOTH

Roebling is now offering Hastelloy B and C filter cloths for exceptional corrosion resistance. Nearly all acids and oxidizing agents can be handled over a wide range of temperature and concentration. John A. Roebling's Sons Co., Trenton 2, N. J.



COMPENSATES WEAR: Lubricated Plug Valve

Known as the Homestead-Reiser Self-Scald valve, a new lubricated plug cock designed to give automatic compensation for wear has recently been introduced. The plug is cylindrical, rather than tapered, and is cut diagonally so as to give a wedging action which not only adjusts the plug for wear, but keeps the sealing surfaces of plug and body in intimate contact at all times. This is said to provide an extra tight seal against leakage, and lower lubricant losses. The design is such that line fluid pressure acts on the plug to promote the sealing effect.

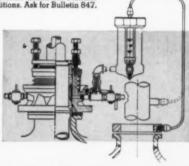
In this valve the port areas are equal to the area of standard pipe. A complete lubricant seal is maintained

(Continued)



PFAUDLER GLASS-LINED PUMP Designed for services beyond the chemical resistance offered by alloys; suitable for temperature and pressure conditions outside the range of other types of linings; facilitates the handling of materials which do not adhere to glass but do adhere to metal; combines high acid resistance with mechanical ruggedness.

metal; combines high acid resistance with mechanical ruggedness. The Pfaudler Pump operates in a vertical position to allow separation of liquid pumped from the stuffing box. It is designed for low speed operation and will handle from 30 to 240 GPM. Equipped with stuffing box for severe chemical service with a patented gas barrier between liquid pumped and the stuffing box. This feature makes the Pfaudler Pump practical for most severe service conditions. Ask for Bulletin 847.



#### AUTOMATIC COUNTERBALANCE LUBRICA-

TION SYSTEM Plaudler Stuffing Boxes must withstand the most severe chemical corrosive conditions. Automatic counterbalance keeps the Stuffing Box flooded with lubricant under slightly higher pressure than the reactor, which excludes all corrosive vapors. Several methods depending on the operating conditions are available. Also, see "Teflon" Packings and ask for Bulletin.

# 5 NeW PFAUDLER DEVELOPMENTS

TO CHECK CORROSION AND IMPROVE
OPERATING PERFORMANCE

Here are five new Plaudier developments which increase the service life and improve operating central of glass-lined equipment used for highly correstor services. Complete details on request.

#### PFAUDLER "TEFLON" PACKING

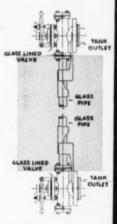
Pfaudler has developed tough porous "Teflon" packing rings without any binding material. These provide complete chemical resistance and are recommended only for the bottom rings of the studing box where they act as an effective stop for the standard packing. Combined with automatic lubrication this frees the stuffing box from most maintenance problems.

PFAUDLER MULTIPLE INLET AND SIGHT BOX ASSEMBLY This glass-lined inlet assembly increases the flexibility of any Pfaudler reactor, old or new. It is made for 2", 3" and 4" ASME flanged openings and can be assembled to take a maximum of four inlet lines as shown. The sight box permits visual observation of rate of flow and prevents leakage of valves. All inlet paths are completely drained without possibility of trapped liquid. Details on request.



#### PFAUDLER GAUGE GLASS

ASSEMBLY This assembly is a metal free gauge glass for highly corrosive acid conditions. Special Plaudler glass-lined fittings include quick acting porcelain shut-off valves and standard 1" glass tubing with "Teflon" packings.



SEE THESE NEW DEVELOPMENTS AND OTHERS AT

# Pfaudler

THE PFAUDLER CO., ROCHESTER 3, N.Y.

ENGINEERS AND FABRICATORS OF CORROSION RESISTANT PROCESS EQUIPMENT Glass-Lined Steel... Stainless Steels... Nickel... Inconel... Monel Metal

#### THE CHEMICAL INDUSTRIES EXPOSITION

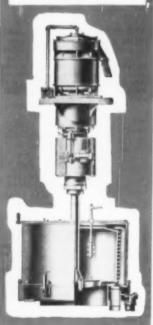
Week of November 28, 1949 Booths 72 and 73

#### CENTRIFUGALS

If your centrifugal requirements preclude the use of "standard" machines, investigate the Roberts Fluid Drive Centrifugal. This machine can be built to do your job.

Only in the Roberts Fluid Drive Centrifugal are these features to be had:

- Standard motor, with current peak less than 40% of direct connected (special) motor drives.
- Torque application uniform and adjustable.
- Simple adjustment for occurate speed control.



Let us show you how these exclusive features can be made to work for your benefit. Your inquiry in-

WESTERN STATES MACHINE COMPANY HAMILTON, OHIO, U.S.A. NEW EQUIPMENT, cont. . .

around the ports and the valve is provided with visible stops to limit operation to a quarter turn.

Homestead Valve Mfg. Co., Coraopolis, Pa.



NEW MECHANICAL PRINCIPLE: Roller Press ;

Installation at the Armour Research Foundation of a new roller type hydraulic press known as the Stacomizer has recently been completed. This is a research model which will be available for industrial experimentation and is expected to lead to the development of commercial installations. The manufacturer has also completed a single industrial size unit which will be employed in a Canadian newsprint mill for dehydrating and preparing bark for use as fuel and for exploring other pulp and paper industry uses.

The machine consists essentially of two rolls, a work roll and a back-up roll, between which a free-floating ring surrounding the work roll is nipped. Power to drive the assembly is applied to the back-up roll, which turns in a fixed position. The work roll is also driven, but is permitted to move in a fixed horizontal plane. The floating ring revolves freely between the rolls which are under hydraulic pressure that can be regulated up to 500 tons. This ring is the same width as the rolls, but about twice their diameter. Material to be processed is fed into the lower part of the floating ring and is carried upward into the horn angle area formed by the outside surface of the work roll and the inside surface of the floating ring.

Movability of the work roll enables the material being treated to form a sheet between ring and work roll, which is under extremely high pressure without shear or grinding action. Any fluids expressed by this pressure flow by gravity from the bottom of the floating ring for collection, while remaining materials are removed by scrapers and conveyors.

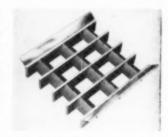
The new machine is expected to prove useful in extracting a wide varicty of oils, juices, and other liquids from solid materials. Recovery of fibers from various plants and the milling of powdered or granulated materials are other possibilities. Little heat is generated owing to elimination of shear and grinding, thus preventing the heat deterioration of heat sensitive materials.

Stacom Industries, Inc., 29-28 41st Ave., Long Island City 1, N. Y.



#### PUSHBUTTON MIXER

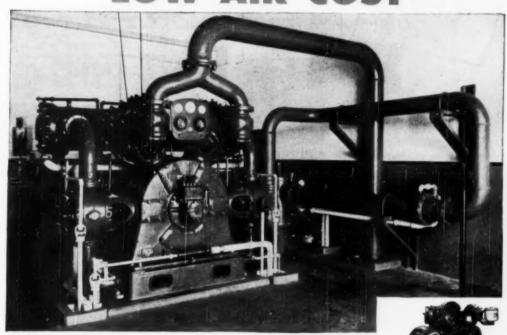
Air cylinders and solenoid air valves now enable the standard fertilizer mixers produced by Worthington-Ransome to be provided with push-button control of charging gate and discharge chute. This speeds up operation and materially reduces manual effort. Worthington Pump & Machinery Corp., Worthington-Ransome Industrial Mixer Section, Dunellen, N. J.



PROTECTS EQUIPMENT:
Grafe Type Separator

Sizes ranging upward from 8 in. square are available in a new line of permanent magnetic separators produced in grate form for protecting the feed openings of various kinds of processing equipment. The grate consists of a grouping of magnetized Alnico bars, with iron spacers. Angular side supports are designed so that the grate can be laid in the bottom of a hopper or floor opening, being readilv lifted out for cleaning. Customarily a wire grid (not shown) is installed over the grate, with rods spaced midway between the magnetic bars to (Continued)

## High Air Capacity . . . Unmatched in LOW AIR COST



The JOY WN-114 is a four-cylinder, two-stage, double-acting compressor producing 1092 to 3656 CFM in single units, and up to 7312 CFM in twin units, depending on pressure. Exclusive "Dual-Cushion" valves provide top efficiency in low-cost air power. © JOY builds the most modern compressors available for either centralized or decentralized air supply—write for Bulletins.

80, in 9 sizes from 81 to 590 CFM.

The JOY WL.





The JOY WN-112, in sizes from 378 to 1828 CFM.



W&D 12058

GENERAL OFFICES: HENRY W. OLIVER BUILDING . PITTSBURGH 22, PA.

IN CANADA JOY MANUFACTURING COMPANY CANADA LIMITED, GALT, ONTARIO



(No. 6)

#### How Activated Carbon Is Used—Powdered Carbon

Many purifying processes call for the use of powdered carbon, the form providing maximum surface area. To make the most of this area, variables such as dosage, pH, contact efficiency and time, and temperature must be considered.

Minimum dosage and the optimum pH of treated liquid are easily determined by the use of the Darcograph with which thousands of users of carbon are familiar.

Contact efficiency depends on thorough agitation in order that the carbon may reach all impurities and "sweep" them from the liquid. This sweeping action takes time—usually ten to thirty minutes.

Generally, carbon does a better job at elevated temperatures, the upper limit being governed by such factors as adverse effect on the product, loss of solvent, and operating requirements of the steps preceding and following the carbon treatment.

Future columns will treat these variables in greater detail. Next month we'll talk about granular carbon.

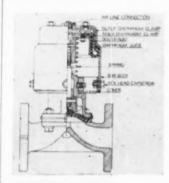


#### DARCO CORPORATION 60 East 42nd St., New York 17, N. Y.

NEW EQUIPMENT, cont. . .

deflect the material and cause streams to wipe the bars. This device not only holds tramp iron and other magnetic particles, but also catches non-magnetic materials sufficiently large to be intercepted.

The Bauer Bros. Co., 1726 Sheridan Ave., Springfield, Ohio.



Valve Actuator

Grinnell-Saunders diaphragm valves can now be provided with a lightweight, compact and leak-proof actuator for either pneumatic or hydraulic operation. The new actuator is a Grinnell application of the Bendix-Westinghouse Rotochamber principle, whereby the use of a rolling sleeve seal permits the elimination of sliding seals or stuffing boxes and does away with sealing and lubrication troubles. It practically eliminates friction. Tests up to 7,000,000 strokes have shown the actuator to have long life and to be free of trouble. Protection against excessive closing pressure is provided by an adjustable positive stop.

Although pressures up to 105 psi, may be used, ordinarily only 50 psi, of actuating pressure is necessary to close the valve against 100 psi, line pressure. Actuators may be positive-acting, negative-acting or double-acting, and are available for valves from

to 6 in. in size.

Grinnell Co., Inc., Providence 1.

R. I.

#### Variable Speed Drive

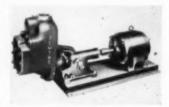
A novel idea in variable speed drives which gives an infinite speed range down to and including zero speed, with constant torque, is being offered under the designation of Specon ED. This drive makes use of a unique motor-generator combination. It consists of a standard a.e. squirrel-cage motor (or other constant-speed prime

mover), two d.c. motors, and a differential gear box. The constant-speed motor or prime mover is coupled with the two d.c. motors through the differential gear box. The d.c. motors are connected in a closed circuit and require no outside source of power.

In operation, the d.c. motors run at varying controlled speeds within a 3:1 range and are the means of controlling the torque and variable speed output shaft. When the output shaft is at its highest speed, one d.c. motor is running at its lowest speed and acting as a generator, supplying power to the other d.c. motor which runs at its maximum speed. The reverse situation holds for the lowest speeds. Since the lowest speeds of the d.c. motors are never below one-third of no load rating, they develop heavy torque at low speed without heating.

Efficiency over the entire range is said to be considerably higher than where speed changes are effected electronically. The device ordinarily uses no electronic tubes and hence no complex electronic control panel. It is said to be particularly suited to processing of web materials requiring constant or decreasing tension between a machine and a winding stand.

Speed Control, Inc., 1420 Depot St., Wickliffe, Ohio,



SELF-PRIMING: Centrifugal Pumps

Six stationary models of a new line of self-priming centrifugal pumps of-fered by the Deming Co. have been designed to cover a range of capacities from 10 to 300 gpm, against heads up to 250 ft. The line also includes a small portable pump with direct-connected gasoline engine for 10 to 90 gpm. against heads of 80 to 15 ft. The pumps employ a built-in, self-priming arrangement which is said to be rapid, automatic and fool-proof, as well as non-syphoning. The impeller is semiinclosed and is of the non-clogging type, designed to pass usual size solids encountered in dewatering work. Adjustment can be made for impeller wear. Certain models are designed with the casing and stuffing box separate from, and bolted to, the support head in such a way that the pump can be (Continued)

# YOU GET ALL

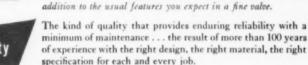
with the BELFIELD "700"

Diaphragm Control Valve













Every Belfield Valve is backed by the entire Minneapolis-Honeywell network of branch offices and factory-trained field engineers, as near to you as your phone.

Upper Spring Flange . . . Duplex Bearings for Stem . . . One-Piece Bonnet . . . Top and Bottom-Guided Disc . . . all in

Investigate these complete time and money saving facilities . . . today . . . write for your copy of Bulletin 700-1.

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BELFIELD VALVE DIVISION
PHILADELPHIA 44, PA.

Offices in principal cities of the United States, Canada and throughout the world

Honeywell

Diaphragm Valves
PROCESS CONTROL SPECIALTIES

Belfield

## WHO PAYS THE FREIGHT?



#### when you buy



The handling of oxygen is a large part of the cost to most oxygen users—and you can ELIMINATE HANDLING COSTS FOR OXYGEN.

With Air Products generators, you take oxygen from the air and push it right through your pipe lines. You assure your supply at low cost, because with these generators there is

NO FREIGHT COST NO HANDLING NO EVAPORATION LOSS NO RESIDUAL LOSS NO DELIVERY FAILURE

If you use over 200,000 cubic feet of oxygen per month, it will pay you to get full information about Air Products generators and our lesse plan. Write today, at no obligation.

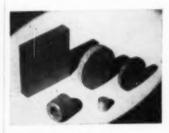
AIR PRODUCTS, INC. P. O. Box 538 Allentown, Pa.



NEW EQUIPMENT, cont. . .

readily adapted for handling corrosive liquids by making the liquid end parts of special alloys, while the support head is of standard east-iron construction. Several types can be furnished in all iron, brouze fitted, or all brouze construction.

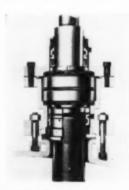
The Deming Co., Salem, Ohio,



WIDE POROSITY RANGE: Stainless Steel Filters

Oilite stainless steel filters, produced from stainless steel powders by powder metallurgy methods, are now in quantity production for chemical industry use. These filters are produced by a Chrysler division in disks, sheets, plain cylinders and cones and can be made with porosity ranging from nearly zero to more than 60 percent, depending on the application. They are said not to be brittle or friable, and to be efficient for filtering, separating, diffusing, and regulating the flow of a wide variety of liquids and gases. If necessary, special shapes can be built to customers' designs.

Amplex Mfg. Co., Division of Chrysler Corp., Detroit 31, Mich.



Agitator Shaft Scal

An improved rotary mechanical seal for shafts is a new Glascote development used on top-entering glass-coated agitators. By eliminating the conventional packed stuffing box, the new seal is said to climinate leakage and constant repacking, while at the same time it permits the use of higher pressures and eliminates friction and wear between packing and agitator shaft.

As the illustration shows, the unit consists basically of a liquid-tight housing, closed at the top and bottom with rotary seals. The revolving metal seal rings, which are packed to the shaft, are maintained in close contact with stationary carbon gland inserts by the pressure of a number of coil springs. A suitable oil or other cooling lubricant is circulated through the housing under slightly higher pressure than the internal pressure of the vessel. The lower seal, which contains the vessel pressure, is made of a corrosion resisting material suitable for the service. The glass coating at this point is trued by grinding, if necessary, to insure efficient packing, but since the ring and shaft rotate together, the packing is not subjected to wear. The mechanism shown between the seals is a double row of tapered roller bearings carrying and guiding the agitator

This mechanism, although designed primarily for glass-lined vessels, is equally suitable for stainless steel or other alloy equipment.

Glascote Products, Inc., 20900 St. Clair Ave., Cleveland 17, Ohio.

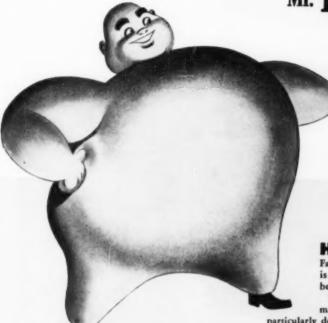


FOR PUMP DRIVE: Vertical Turbine

For driving vertical centrifugal pumps and other vertical units requiring horsepower ratings up to 90 b.hp., the Whiton Machine Co. has developed a small vertical steam turbine built of semi-steel, or east steel, to meet requirements for practically any steam pressure and temperature. The turbine is equipped with both constant (Continued)

## "You'il make better alkyds my way,"

Mr. fatty acid!



fatty acids

ETTER COLOR

Mere's a little lesson in logic, says Mr. Fatty Acid. If B is better than A . . . and C is like B but costs less . . . what's your best buy?

Now let's translate that logic to alkydmanufacture. Soya oils, as you know, are particularly desirable for the manufacture of alkyds. They offer a combination of characteristics possessed by no other oil . . . better color, flexibility, durability, air drying and baking properties. And soya fatty acids are even better than soya oils . . . lighter in color, faster in the kettle because of direct esterification . . . easier

That brings us to ADM's specially developed distilled Soya Fatty Acids. We offer four types: Water White, Regular, RO-10 and RO-4. The latter two are surprisingly economical. Yet they're of unusually high quality.

If you like the reasoning, it points directly to the coupon below. Why not mail it now . . . and be on the way to finer alkyds at lower cost!

Take the SCIENTIFIC SHORTCUT with

ANIELS-MIDLAND COMPANY

## MAIL THE COUPON TODAY ARCHER-DANIELS-MIDLAND CO.

600 ROANOKE BUILDING

Please send material checked on ADM FATTY ACIDS:

Chart No. 77 showing Com-position and Constants of Eatly Acids Data for making Alkyds Bulletin No. 78 on RO-10 Soybean Fally Acids

Сотрант



You can reduce the hazards of processing, handling or storing inflammable gases or liquids with R-C Inert Gas Generators. They produce cheaply a mixture of nitrogen and carbon dioxide, using oil or gas as fuel. Both fixed and portable units have these outstanding advantages;

- 1. Large capacity in terms of weight and cost.
- 2. Low operating and maintenance cost.
- 3. Quick adjustments for complete combustion.
- 4. No adjustments, for same fuel, needed after shut-down.
- 5. Operation not affected by variation in back pressure.
- 6. Extremely quiet operation.

With capacities from 1,000 CFH to 50,000 CFH, R-C Inert Gas Generators provide quick, dependable protection, at low cost. They are equally efficient, also, for inert gas production for processing operations. Write for details in Bulletin 100-B-14.

ROOTS-CONNERSVILLE BLOWER CORPORATION 910 Jefferson Avenue, Connersville, Indiana

ROOTS-CONNERSVILLE



BLOWERS - EXHAUSTERS - BOOSTERS - LIQUID AND VACUUM PUMPS - METERS - INERT GAS GENERATORS

. ONE OF THE DRESSER INDUSTRIES .

NEW EQUIPMENT, cont. . .

speed and emergency governors, and is provided with a bolting flange at the lower part of the casing to bolt directly to the flange of the driven unit.

Whiton Machine Co., New London, Conn.



WEIGHS, INTEGRATES: Conveyor Scale

A unit type belt conveyor scale, assembled and shipped as a complete unit requiring fewer than a dozen bolts for its complete installation, is being offered under the name of Transportometer by the Sintering Machinery Corp. The unit can be installed on any existing horizontal, inclined or declined belt conveyor of any width or speed. It automatically weighs, indicates and totalizes any tomage up to 2,000 tons per hour. It can be used for automatic control of feed conveyors or other feeding devices and may be equipped with remote recording or totalizing equipment.

Sintering Machinery Corp., Transportometer Division, 60 Wall Tower, New York 5, N. Y.

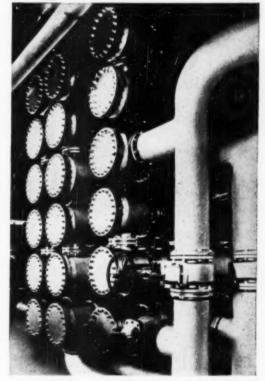


EASY CLEANING: Horizontal Plate Filter

For applications involving a large volume of filtrate and frequent cleaning of the filter plates during the production run, the Sparkler Manufac-(Continued)

## TRENT

## tubing chosen for world's largest sulfite liquor alcohol plant



Stainless steel heat exchangers for cooling waste suffite liquor to fermentation temperatures in the alcohol process.

Using waste sulfite liquor from the adjacent Gatineau Mills of the Canadian International Paper Company, the new \$3 million plant of Commercial Alcohols, Ltd., of Montreal, has commenced production with a capacity of 9,000 U. S. gallons of alcohol per day.

Design, engineering and construction were carried out by Vickers-Vulcan Process Engineering Company, Ltd., a joint subsidiary of The Vulcan Copper and Supply Company and Canadian Vickers, Ltd.

The extensive use of stainless steel throughout the processing is a significant endorsement of the reputation stainless steel has established in the pulp and paper and the chemical industries. To this reputation then the made important contributions, particularly by demonstrating the advantages of precision-finished tubing—machine-formed, machine-welded and machine-sized for uniformity from ½8" to 30" inclusive.

It is noteworthy, therefore, that TRENT tubing was chosen for all services requiring stainless steel piping and tubing, including sulfite liquor lines, heat exchangers, and other stainless steel process piping in the world's largest sulfite liquor alcohol plant. Perhaps you have an application that can best be solved by TRENT tubing. We will be glad to give any desired assistance. Informative data on request.

#### TRENT TUBE COMPANY

Subsidiary of Crucible Steel Company of America General Office and Plant—East Troy, Wisconsin Sales Offices: Chicago: 4501 W. Cortland St. New York: Chrysler Building



STAINLESS STEEL TUBING



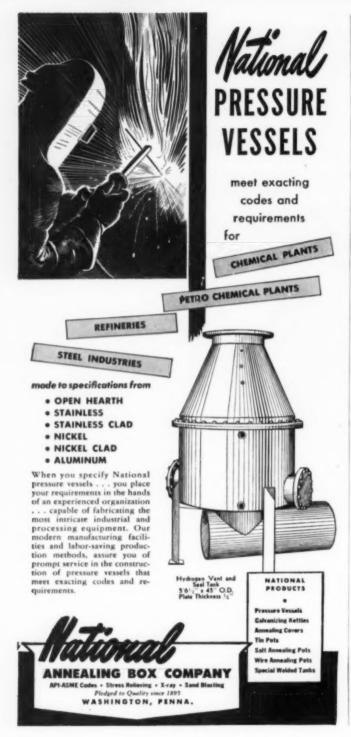
turing Co. has developed a new horizontal plate filter which emphasizes casy cleaning without removing the filter plates. The filter is a vertical cylinder containing horizontal plates, and equipped with a side panel which can be opened to expose all plates. Through this opening the filter cake can be washed off completely and quickly. The operation is said to take only one or two minutes. At the end of the filter cycle all plates can be removed at one time through the top of the filter to facilitate insertion of fresh filter paper or cloth. A wide range of construction materials and linings can be provided, and filter capacities may range from 60 to as high as 60,-000 gph.

Sparkler Mfg. Co., Mundelein, Ill.



#### Dry Chemical Extinguisher

More efficient expulsion of the extinguishing agent, lighter weight, and unusual compactness are claimed for the new Quick Aid dry chemical extinguisher offered by General Detroit Corp. and its West Coast affiliate, General Pacific Corp. This extinguisher expels a fine white powder onto the blaze which releases carbon dioxide and smothers the fire. The powder is expelled by carbon dioxide contained in a small cylinder inside the main extinguisher shell. To start the extinguisher, the operator punctures the cylinder by squeezing a valve mounted on top of the extinguisher. A second valve on the hose controls the flow of extinguishing agent. Improvements in funneling the powder directly into the outlet are said to increase operating efficiency as much as 10 percent, while the use of an extremely lightweight shell of hardened and drawn brass reduces the extinguisher weight and facilitates its use. (Continued)





Depend on the general-purpose Type E Turbine for the kind of service you want... whenever and wherever you want it.

Prolonged exposure to abrasive dusts fails to more than dirty up the outside casing. Type F construction keeps foreign matter out, and eliminates close-sliding fits. Materials used in construction resist corrosion and erosion... you get a turbine that's rugged.

Investigate these, and all the other vital features wrapped up in industry's standard turbine . . . the Type E. Get complete information from your nearby Westinghouse office, or write for your copy of the Type E Turbine Book, B-3896. Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa. J-50500-A





 $\overline{\mathbf{I}}$  has are 12% chrome-iron, cast statically. They're machined and finished to close tolerances.

Producing chrome-iron, chrome-nickel and nickel-chrome static castings has been our business exclusively since 1922. We helped pioneer this phase of the high alloy casting business just as we helped pioneer centrifugal castings beginning in 1931.

At Scottdale, we have one of the most modern high alloy foundries in the country. We have exceptional technical controls and a 400,000 volt X-ray machine. We can produce individual static castings up to 7 ½ tons in weight and machine or otherwise finish them to specifications.

In short, we have a broad reliable service in connection with high alloy castings.

THE DURALUY COMPANY

Office and Plant: Scottdale, Pa. • Eastern Office 12 East 41st Street, New York 17, N.Y.

P. O. NELSON

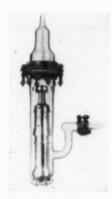
[18] MiCharack Rolling

F. B. CORNELL & ASSOCIATES

New Equipment, cont. . .

The extinguisher has been approved by Underwriters' Laboratories.

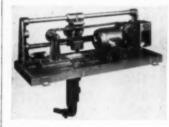
The General Detroit Corp., Detroit, Mich.



HIGH PERFORMANCE:
Diffusion Pump

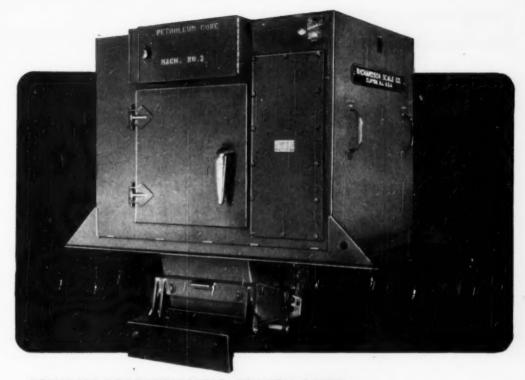
Pumping speeds up to 67 liters per second, and attainable vacuum of 4 × 10 mm. Hg, are claimed for a new glass-barrel high vacuum oil diffusion pump developed by Eitel-McCullough, Inc. The pump has a three-stage metal diffusion unit. It requires no liquid cooling and no charcoal trap. Designated as Type HV-1, it has standard flanged glass pipe fittings.

Eitel-McCullough, Inc., San Bruno,



Accurate, Rugged:
Automatic Sampler

Manufacturing and sales rights to an automatic sampler which is said to feature accuracy and ruggedness, have been secured by the Hardinge Co. The new sampler, now on the market, takes periodic cuts from a stream of moving material, either wet or dry, at any stage in a continuous process. The unit is entirely automatic and can be set to operate at any time interval from 5 to 60 minutes. When activated by a time switch, the sample cutter moves horizontally at a constant speed (Continued)



## ACCURATE PROPORTIONING AT HIGH SPEED... WITH THE ALL-ELECTRIC RICHARDSON BULK SCALES

Eliminate hidden losses in weighing, proportioning, and blending...maintain exact control over your mixes...with a battery of the NEW, all-electric E-50 Richardson AUTO-MATIC BULK WEIGHING SCALES.\*

Whatever you're batching, whether it's baby powder or an Asbestos shingle mix, you'll have accurate control over the proportions of each ingredient. Result; a uniform end product. Here's why:

- Different materials are weighed in any desired proportion with perfect coordination of discharge.
- Discharge on a time schedule, pre-set for each material.
- · Accuracy of each weighing proved by sensitive indicator.
- Proportioning automatically stops if any scale runs out of material.

The smooth, all-electric operation of the E-50 speeds up the processing cycle. Scales can be set to function simultaneously, singly, or in groups. Completely dustproof housing; electric controls separately encased, supplied for Class 2-Group G or Class 1-Group D hazardous locations.

#### AND WHEN YOU BAG CHEMICALS...

You'll need the all-electric E-50 AUTOMATIC BAGGING SCALE for fast, accurate net weighing of practically all materials packaged in open-mouth paper or textile bags. Still faster is the E-50 DUPLEX BAGGER. Actually 2 E-50's combined, with bifurcated top hopper and common bagging hopper, bag holder and motor drive. It will double output with just one operator and without sacrificing the accuracy of a single scale at a more conservative speed.

Normal Range: -5 lbs. to 25 lbs. and 25 lbs. to 50 lbs. Other models are available for greater capacities.



\*See the new, exceptionally fast E-50 bulk scale in action at the Exposition of Chemical Industries in Grand Central Palace, New York City, Nov. 28 to Dec. 3 inclusive — Booth Nos. 659-660.

#### RICHARDSON SCALE COMPANY

CLIFTON, N. J.

Atlanto • Boston • Buffalo Chicago • Minneapolis • Wichita New York • Omaha • Philadelphia Pittsburgh • San Francisco Montreal • Toronto € 5894

## He didn't forget...

## He just took a chance!



When workers risk their eyes, with disastrous results to both themselves and the company alike, it's time to look into the cause of unsafe practices.



Goggle Style TAW51

Willson answers the problem of getting safety equipment worn by designing the utmost comfort into their entire line of eye and respiratory protective devices. The goggles illustrated have eyecups that are molded to fit the bony structure around the eyes. The chain bridge and elastic headband are adjustable for comfortable fit. And the Super-Tough\* lenses meet or exceed Federal Specifications for optical clarity as well as impact resistance.





DAILY REMINDERS

Such as Willson "Blind Man" Safety Posters keep workers aware of the need for wearing goggles. Supplies available on request.

"T. H. Reg. U. S. Pat. Office

WILLSON PRODUCTS, INC., 223 WASHINGTON STREET, READING, PENNA.











New Equipment, cont. . .

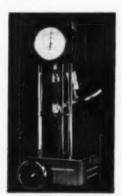
across the stream of moving material, diverting a representative sample into a sampling launder or container. Cutter movement is uniform as to stroke, speed and length during each cutting operation.

The Hardinge Co., York, Pa.



ELECTRONIC VULCANIZER

It may not be long, according to Goodrich, before rubber goods such as this can be produced from mixing mill to box car in 20 min.! This vulcanizer, operating electronically, has produced over 9,000,000 ft. of red syringe tubing in 15 months at Plant No. 4 of the Goodrich Co. It has been developed and patented by the company. The B. F. Goodrich Co., Akton, Ohio.



LOW COST:

#### Stress Tester

To enable every plant that requires low-range testing to be able to afford a machine for this purpose, W. C. Dillon & Co. has developed a low cost hand-operated instrument with a range of 0 to 100 lb. over all, and with scales for 0 to 10, 0 to 20, 0 to 50 and 0 to 100 lb. The machine is universal in application, handling specimens under tensile, compression, transverse (Continued)

For Setter Use of Cubic Volume ...

CUSTOM - BUILT EQUIPMENT

For the Chemical and Food Processing Industries

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JOHNSON CITY TENN. ELIZABETH N. J.

#### For Better Use of Cubic Volume . . .

For Low Cost Lift and Carrying . . .

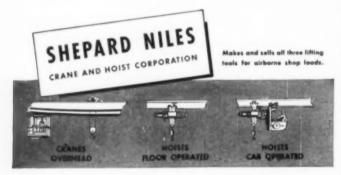
### STACK FROM THE AIR



Stacking rolls of paper stock for storage with a "through the air" movement has lowered handling costs and produced more solid stacking in the storage area.

This warehouse picks up the loads at the door with overhead equipment, specially designed by Shepard Niles to operate with minimum headroom. No aisle space or turning radii are needed, every cubic foot of area is used for stacking "from the air."

This is one example of the service Shepard Niles specialists can supply to those with materials handling problems. There is economy in knowing where to leave off with one method and take up with the cheaper, faster, safer, "through the air" movement.



382 SCHUYLER AVENUE . MONTOUR FALLS, N. Y.

NEW EQUIPMENT, cont. . .

and shear stresses. It is hand-operated through a worm-and-gear drive, with provision for later motorization at any time. Calibration can be in decimals of a pound, ounces or kilograms. A variety of grips is available for different kinds of specimens.

W. C. Dillon & Co., 5410 West Harrison St., Chicago 44, Ill.

#### Briefs . . .

SAFETY FEATURE. The Type VVH pressure-vacuum vent valve previously described in these pages is now available with a flame arrestor bank to prevent propagation of flame into storage tanks containing volatile liquids. The danger of fire is greatest when the tank is venting and releasing volatile vapors into the atmosphere. With the flame arrestor bank, any flame resulting from a flash of lightning or from fire nearby is prevented from flashing back into the tank. The arrestor bank, of rolled aluminum construction, can be removed readily for cleaning. Black, Sivalls & Bryson, Inc., 720 Delaware, Kansas City 6. Mo.

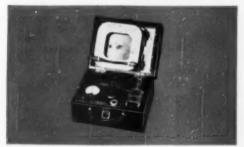
DURIMET 20 SHEET. Durimet 20 is now available for the first time in sheet and plate. This alloy, suitable for corrosive applications which ordinary stainless steels cannot withstand, has previously been available in castings, bar, strip and tubing. It is now being produced for stock in gages of 24 to 11 and plate thicknesses from 25 ga. to 3 in. The Duriron Co., Dayton 1, Ohio.

DE-I IMPROVEMENT. Recent research by Resinous Products has shown that a judicious mixture of several of its Amberlite resin exchangers in water de-ionization units makes it possible to obtain a wide range of capacities within a fixed bed volume. This means that ion exchange unit manufacturers can employ a smaller number of vessel diameters and heights, which should result in cost savings. This mixing of different exchangers is found not to produce any increase in attrition, nor does it appreciably change hydraulic characteristics of the unit. The Resincus Products Division, Rohm & Haas Co., West Washington Square, Philadelphia, Pa.

STRONG ACID VALVE. Handling of 66-deg. Baume sulphuric acid can be accomplished with a new plastic diaphragm available for the Hills-McCanna Saunders type diaphragm valve. These diaphragms are built for sizes from ½ to 4 in., with a (Continued)

## HERE'S HELP FOR YOUR TESTING AND MEASURING PROBLEMS

Use one of these 3 instruments...or select from more than 300 other G-E stock instruments



#### To Cut Costs of Balancing Rotors

-use the G-E portable dynamic balancer

By using the G-E portable dynamic balancer to balance rotors in their own bearings, you can drastically reduce the time and cost of balancing rotors in generators, motors, and in other machines. One operator alone can balance two-bearing machines, and he needs to make only three runs.

Ideal for factory-testing, you can use the device for installation or maintenance work, and for field service on any rotor within a speed range of 600 to 6000 rpm and weighing more than 30 pounds; Write for GEA-320.

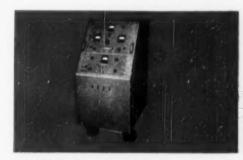


#### To Detect Insulation and Winding Faults Quickly

-use the G-E winding-insulation tester

You can speed up production-line testing of motors, transformers, and generators by using the G-E winding-insulation tester. At one G-E plant, for example, more than 4000 motors a week are tested with one device.

Less than one minute is required for a complete test, which includes resistance, impedance, turnbalance, and complete high-potential tests. The operator can determine the nature of the defects by the wave shapes of the oscillograms. Write for GEC-321. You may find that General Electric engineers can help you by recommending one of the many G-E stock devices and instruments. Your problem, especially if it is one common to industry, may even justify developing new equipment. Send the coupon today to Apparatus Department, General Electric Company, Schenectady, N. Y.

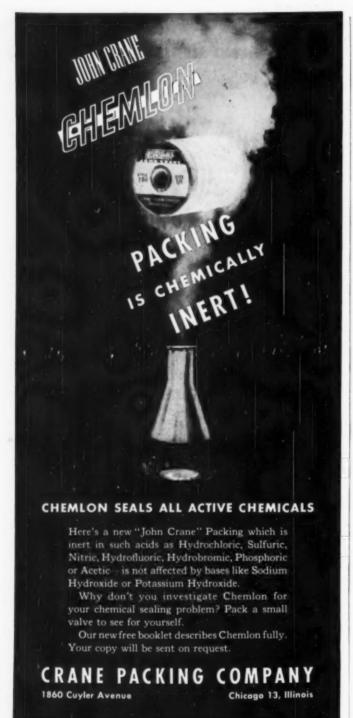


#### To Locate Leaks in Closed Systems

-use the G-E Type M Leak Detector

By locating even the smallest leaks while your products are on the production line, you reduce operating costs, cut service expense in the field—and safeguard the good will of your customers. Used in G-E refrigerator production for more than two years, the Type M detector uses helium as a tracer. The detector is so sensitive that it can detect one part of helium in 200,000 parts of air: Write for GEC-336.

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| b   | General Electric Company  |
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NEW EQUIPMENT, CORT. . .

choice of east iron, east steel, Durimet or glass-lined bodies. All sizes are produced for pressures to 100 psi. and temperatures to 125 deg. F. The Hills-McCanna Co., 3025 North Western Ave., Chicago 18, Ill.

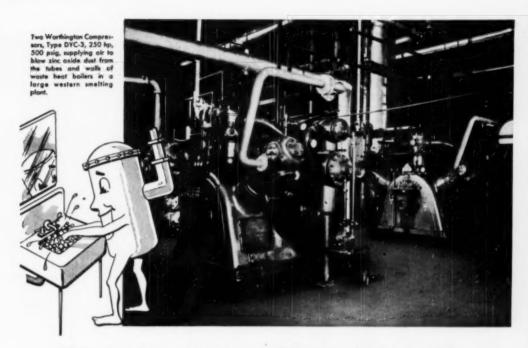
ELECTROSTATIC SAMPLER.

Mine Safety is now offering a new electrostatic sampler for airborne dusts, fumes and smokes. The device is equipped with a portable sampling head and a specially designed power pack, together with a high-voltage indicator. Determinations can be made by weight without removing the sample from the tube, or the sample may be removed for other methods of quantitative or qualitative analysis. Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh 8, Pa.

FAST ELECTRODE. A new Entectic electrode known as the Entec-Hand-Omatic is an a.c.-d.c., no-gap electrode which is merely pressed against the metal and drawn straight along, like a pencil, without any back or forth weaving motion. This is said to yield a perfect weld automatically since there is no are gap maintained and operation is easy. The new electrode is said to work with all mild steels and low allows, as well as high-tensile steels. No special equipment is needed. Entectic Welding Alloys Corp., 40 Worth St., New York 13, N. Y.

VALVE MOTOR. Gate valves may now be operated by a simplified fluid-motor operator of Crane design. The motor unit comprises motor, gear box and yoke, and is bolted to the valve bonnet. The motor derives its power from five flexible diaphragms mounted radially about an eccentric on the drive shaft. Operating fluids may be liquids or gases under pressures from 40 to 300 psi. These valve motors are suitable for valve sizes from 4 to 30 in. The Crane Co., 836 South Michigan Ave., Chicago 5, Ill.

CAR SHAKER. Link-Belt has augmented its present line of car unloaders with a shaker for hopperbottom gondola cars. The shaker, normally suspended from a hoist, is readily lowered to the top of the car, employing rotation of a vibrator shaft to impart heavy hammer-like blows to the car. However, operation is said to be relatively quiet, with unloading speeds of eight to ten cars per hour under proper circumstances. Link-Belt Co., 307 North Michigan Ave., Chicago 1, Ill.—End



## Here's Your Modern, Money-Saving Way To Make Boilers "Come Clean"!

## Worthington Compressors Do A Real Job Of Soot Blowing... Faster, Better, At Less Costl

Boiler cleaning by hand is a messy, makeshift carry-over from the horse-and-buggy era. Today, soot-blowing by compressed air is an economic necessity. Originally developed for low pressure boilers, air soot blowing has shown so many advantages over steam as a cleaning agent that its use has now extended to central stations and big power plants throughout the nation.

The reasons are plain. Air soot

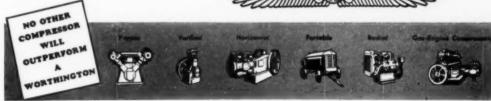
blowing saves fuel and feed-water make-up, while lessening the possibility of tube erosion. It uses inexpensive, low-temperature piping, with piping insulation eliminated. It reduces soot blower maintenance, provides a dryer blowing medium and a more effective means of slag removal. Finally, its complete adaptability to automatic control reduces costly manual operation throughout long years of service.

#### "Heart" Of Every Soot Blowing System

is its compressors . . . and Worthington builds these for every application . . . builds them to give you longer, quieter, smoother service — and air at lower cost. For further facts proving there's more worth in Worthington, write for booklet, "Worthington Compressors for Soot Blowing". Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, N. Y.

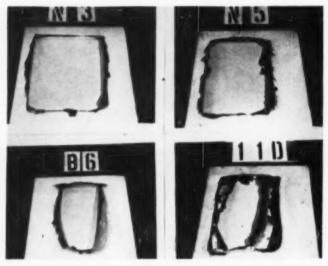
### WORTHINGTON





## New Products and Materials

JOSEPH A. O'CONNOR, Assistant Editor



#### Coatings Make Doped Fabric More Fire-Retardant

The National Bureau of Standards has developed fire-retardant coatings for fabric-covered aircraft that effectively double the time interval between ignition of the fabric and its destruction by fire.

Wind-tunnel burning tests were conducted on doped fabric panels treated with the experimental coatings. The burning tests were carried out at the Indianapolis Experimental Station of the Civil Aeronautics Administration. A panel treated only with the highly flammable cellulose nitrate dope was destroyed in 2 sec. (above, top left). It took 4 sec. to destroy a panel coated with cellulose nitrate dope plus four coats of a fireretardant mixture (above, top right). Destruction time for a panel coated with the less flammable cellulose acetate butyrate dope but with no fire-retardant coating was 6 sec. When the (above, bottom left). panel coated with cellulose acetate butyrate dope got in addition four coats of the same fire-retardant mixture, however, it took 12 sec. to consume it (above, bottom right).

The highly flammable cellulose nitrate dope used on airplane fabrics has been responsible for much loss of life and property by fire. Although dones based on other cellulose derivatives, such as ethyl cellulose, cellulose acetate and cellulose acetate butyrate, are much more difficult to ignite and have a much lower flame velocity, even though they are unsatisfactory in a power plant fire, in which flame from burning gasoline or oil may be in continuous contact with doped fabric for several seconds. Yet no fire-retardant film-forming materials are known that tauten airplane fabrics as effectively and as permanently as do the dopes based on the cellulose derivatives. Unfortunately, the addition of resins or other fireretardant substances to these compounds lessens their capacity to tauten. Efforts were therefore directed toward the development of highly efficient fire-retardant coatings to be applied to the surface after it is already doped. In designing the coatings, the peculiar requirements of aircraft use made it necessary to consider not only fire-retardant effectiveness but also aerodynamic smoothness, adhesion, flexibility, effect on tautness of the substrate dope, application characteristics, durability and resistance to gasoline, oil and ethylene

Although very few of the fire-re-

tardant coatings that were developed in this investigation have the flexibility and durability of the cellulose acetate butyrate dope, several of them are of sufficient utility to merit further development. The film-forming bases which gave the best results all have considerable organically combined chlorine, which on pyrolysis gives off appreciable quantities of hydrochloric Pigments such as zinc acid gas. borate and antimony oxide were also quite effective in increasing the production of non-combustible gas. Magnesium ammonium phosphate, on the other hand, is too water-soluble for outdoor use. Antimony oxide and calcium carbonate in combination appeared to be superior to antimony oxide alone. The maximum pigment content compatible with flexibility and weathering requirements was about 40 percent of the solids. though fire-retardancy is increased for higher pigment contents, such overpigmented coatings are not sufficiently durable.

National Bureau of Standards, U. S. Department of Commerce, Washington 25, D. C.

#### MOSTLY BILINOLEIC:

#### Dimer Acid

Dibasic acid, better known as a dimer acid, now is commercially available from Emery Industries, Inc. The dimer acid represents a commercial form of dimeric polymer consisting essentially of dilinoleic acid.

The new dimerization plant of Emery Industries permits production of an acid of light color and high dimer-trimer ratio at an attractively low cost.

Applications for Emery dimer acids are in polyamide resins, linseed and tung oil substitutes, polyesters, simple esters, sulphurized esters, resins, drying oils, paints, varnishes, soaps, plasticizers and emulsion breakers.

Uses for dimer acids are based on their chemical and physical characteristics. Dimer acids undergo the typical reactions of dicarboxylic organic acids. In some cases, utility is supported by physical properties such as low volatility, high flash and fire points, tackiness, viscosity.

Emery Industries, Inc., 4300 Carew Tower, Cincinnati 2, Ohio.



#### Chips of Salvaged Wood Turned Into Hardboard

At Forest Grove, Ore., the Forest Fiber Products Co. is successfully turning Douglas fir snags left in the wake of disastrous forest fires in the western Oregon Coast ranges into a usable hardwood product, called Forest Hardboard. Forest Fiber Products Co. is a subsidiary of Stimson Lumber Co., which also operates from salvaged logs at Forest Grove. Unusable wood at the Stimson mill, mostly short pieces, ends and similar material, is diverted to hardboard production by Forest Fiber Products.

Selected wood, bark-free and rotfree, is chipped, reduced to fiber and then to pulp. The pulp is deposited in slurry chests for chemical treatment. A special mixture of waxes and resins is used to give the board waterproofness. It is then run out in an endless blanket and cut to required lengths by a water jet. This product is compressed in a huge press under 180 lb. steam and at 450 deg. F. A humidifying process imparts a glassy surface to the hardboard. Packaging completes the process.

Finished product is in 4-ft. widths and 8- or 16-ft. lengths; thickness can be \$\frac{1}{2}\$, \$\frac{1}{2}\$ or \$\frac{1}{2}\$ in. Various degrees of hardness are obtainable, from that approaching rock to that of a board that can be sawed and planed like ordinary lumber.

Uses of the product are many. The building industry can use it for construction purposes. It can also be used to make toys, counters, showcases, mirrors, picture frames and similar products.

Stimson Lumber Co., the parent organization, is the exclusive sales agent for Forest Hardboard.

Forest Fiber Products Co., Forest Grove, Ore.

#### FOR ACETATE PIBERS: Red Dvestuff

First of an entirely new family of dyes for cellulose acetate fibers—Eastone Red GLF—has been announced by Tennessee Eastman Corp. The new dye is said to be exceptionally fast to light even in pastel shades, and far surpasses any known acetate red in this respect.

Other properties claimed for it include excellent fastness to gas fading, sublimation, crocking and hot pressing, as well as very good fastness to perspiration and washing. Good dischargeability is also reported.

Eastone Red GLF is a homogeneous, highly dispersed dye that produces a medium shade of red with a yellow cast. It possesses good exhaustion and level-dyeing characteristics with very good penetration and build-up at temperatures of 160 to 190 deg. F. Technical data and samples can be secured from the manufacturer.

Tennessee Eastman Corp., Kingsport, Tenn.



Calcined Magnesia

General Magnesite & Magnesia Co. announces that it is now marketing calcined magnesia just as it comes from the kilns, packaged in heat-sealed polyethylene bags for protection from moisture and carbon dioxide. The magnesia reaches the user with its properties as a scorch-resisting material in neoprene undiminished.

Magnesia which is calcined for maximum scorch resistance in neoprene compounds is so sensitive to carbon dioxide and to moisture from the atmosphere that pulverizing, with consequent exposure of large surface areas to the air, greatly reduces its efficiency.

The fact that the material is now supplied in lumps instead of in powder form does not retard the rate of cure. The mixing stresses in Banbury mixers and on rubber mills are so great that the very fragile lumps are completely pulverized and dispersion in the rubber is at least equal to that of any powdered magnesia.

Results of independent tests have

been uniformly favorable, and compounders of neoprene report satisfactory performance of the calcined magnesia in lump form.

By omitting the valueless grinding process, and packaging in polyethylene, an excellent barrier for both moisture and carbon dioxide, it is now possible to supply magnesia calcined for peak efficiency as a scoreh-resisting material in neoprene.

General Magnesite & Magnesia Co., Plymouth Meeting, Pa.

REACTIVE:

#### Trifluoroacetic Acid

Research samples of a reactive fluorochemical are now being offered for sale by Minnesota Mining & Manufacturing Co. The compound is trifluoroacetic acid, CF<sub>2</sub>COOH, a colorless, corrosive liquid that is one of the strongest organic acids known.

The acid has a strong pungent odor, boils at 71.1 deg. C. at 734 mm., and freezes at -15.3 deg. C.

Trifluoroacetic acid is a chemical intermediate that may prove useful in the preparation of such products as dves, pharmaceuticals, resins and plastics. It will undergo most of the usual organic reactions of acetic acid.

Presence of the fluorine atoms contained in this fluorochemical enhances the flame resistance of compounds made from it.

The new fluorochemical, precursor of a group of fluorinated acids to be offered by Minnesota Mining, is made in the company's pilot plant in St. Paul by an electrochemical process. It is available in experimental quantities. Price is \$10 a lb. Samples and technical data can also be secured.

Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul 6, Minn.

#### FLAME-RESISTANT: Hydraulie Fluid

Development and production of Lindol HF-X, a new flame-resistant hydraulic fluid with a tricresyl phosphate base, is announced by Celanese Corp. of America.

As Lindol HF-X is not a chlorinated compound, it does not give off noxious fumes when exposed to very high temperatures. Because of this feature, coupled with its non-burning property, high lubricity, corrosion resistance and low cost, Lindol HF-X is expected to be widely employed by die-casters and users of such hydraulically operated installations as welding machines and coal mining equipment.

Lindol HF-X is available in a wide (Continued)

range of viscosities and viscosity indices. It can be used in any system equipped for non-hazardous hydraulic fluid operation or in any other system with but few changes.

According to Celanese, the initial cost of Lindol HF-X is lower than that of any comparable material.

Celanese Corp. of America, 180 Madison Ave., New York 16, N. Y.



#### Metal Cleaner: Brush It On, Wipe Dirt Off

For cleaning metal surfaces before applying an organic finish to them a new type cleaner has been developed by Enthone, Inc. This surface-preparing material is called Surprep. Essentially it is a solvent-phosphoric acid type cleaner that can be used on aluminum, steel and zinc surfaces. It degreases and prepares steel for painting at room temperature.

The product is a liquid that contains oil-displacing chemicals. It quickly dislodges oil, grease and other organic materials from metal surfaces so that they can be readily wiped off with a cloth or rinsed off with water. The new cleaner also contains phosphating and other rust-removal chemicals that dissolve rust, oxide and scale while the oil-removal agents operate.

Surprep is easy to apply. It is used either full strength or diluted with water. It is applied by brushing with a paint brush or wiping with a cloth. After several minutes the surface can be wiped off with a cloth, and it is then ready for painting. The surface can also be hosed off with water and then wiped dry. The surface is given a uniform etch and a light phosphate film is deposited that gives an excellent "tooth" for the paint.

Surprep is supplied in 1-gal. jugs, \$and 12-gal, carboys, and 50-gal, bbl. Enthone, Inc., 442 Elm St., New Haven 2, Conn.

#### AT REDUCED PRICES:

#### Krypton and Xenon

The rare gases krypton and xenon are slated for a host of new uses in a diversity of products and processes. now that Linde Air Products Co. is turning out these gases in big volume and at radically reduced prices. Until now, widespread use of these gases has been held back by their high cost.

Occurrence of krypton in the atmosphere is one part in one million; of xenon, one part in 12 million. Hence their separation and purification have presented complicated problems. But after five years of development work and considerable expenditures, Linde has turned the trick and is now producing krypton and xenon on a large scale. As a result, prices have been cut.

Krypton, xenon and the other rare gases are inert and will not combine with other elements under any conditions. This makes them superior to nitrogen for certain purposes, since nitrogen, although considered inert, will combine with many elements at elevated temperatures. Users of nitrogen will be encouraged to investigate the advantages of krypton, senon, argon and the other rare gases.

How do krypton and xenon compare with argon, the most widely used tare gas? Krypton and xenon have the advantages of lower thermal conductivity, lower electrical resistance and lower ionizing potentials. Further research promises to uncover other unique characteristics of these gases and their mixtures.

Krypton has been used recently to fill fluorescent lamps, miner's cap lamps and other minature lamps, and krypton or xenon might be used instead of argon for incandescent lamps, In these applications, krypton's properties may give either substantially longer life or increased operating efficiency and brightness, without increasing power consumption. Argon is now used in ionization chambers for tracking cosmic rays, an application where krypton and xenon hold promise of being superior. Geiger-Muller counters for detecting and measuring radioactivity use argon, krypton and xenon; the last two may be used in increasing quantities.

Xenon has replaced mercury vapor in certain thyratrons and vacuum tubes. Unlike mercury, xenon will not condense at low atmospherie temperatures, and has electrical propcrties similar to mercury vapor. Xenon is being used in photographic "speed lamps" of the gas discharge type, and for other specialized uses.

Refined krypton and xenon are

available in 1- and 2-liter glass flasks, and in 400-, 500-liter and larger steel cylinders. The price of krypton in steel cylinders has been slashed more than 50 percent, that of xenon in cylinders somewhat less than 50 percent. Purity standards are high. The krypton contains less than 1 percent xenon; the xenon, less than 2 percent krypton. Trace quantities of oxygen and hydrogen and less than 500 ppm. of mitrogen are found in both gases.

Linde is interested in current research on krypton, xenon or argon that is being conducted by industry, the government or universities. The company stands ready to cooperate in rare gas research.

Linde Air Products Co., 30 East 42nd St., New York 17, N. Y.





#### Matted Cotton Filler Strengthens Laminate

A new material with exceptionally high impact fatigue values and superior machinability is being produced by the Synthane Corp., manufacturer of laminated phenolic plastics for industry. These properties, obtained without sacrifice in electrical or chemical values, stem from the use of a cotton mat filler whose fibers lie in random distribution within the laminations (above, right). Thus the texture of the new filler contrasts with the woven fabric used as filler in Grade C Synthane (above, left).

Even distribution of the matted, unwoven cotton fiber gives the new Grade L-RF a more uniform strength and superior resistance to repeated impact. The new mat material is made from a filler having longfiber virgin cotton, and should not be confused with mat materials made from linters.

Average values for tensile, flexural and compressive strength of the new Synthane Grade L-RF considerably exceed the NEMA averages for Grade L and Grade C. It is in flatwise impact fatigue values, however, that Grade L-RF demonstrates its greatest superiority. Tests conducted by Synthane Corp., consisting of dropping a 1-lb. weight from a height of 1 ft. at a rate of 40 blows a minute on a notched impact specimen, showed that Grade L-RF resisted 5,000 blows,

(Continued)

FROM SHELL CHEMICAL

# ALLS COHOL ALCOHOL CH2=CH-CH2OH

### ...in tank cars and drums

Here are typical reactions of Allyl Alcohol that may suggest ways through which you can accomplish useful chemical syntheses:



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The same reliable pseasurement of liquids that has characterized Niagara Volumetric Liquid Meters for over 50 years is now being made available in a new line of NIAGARA Chemical Meters. Since all internal parts of the new Niagara Meters are of No. 316 stainless steel—except the special-type measuring piston—a wide range of corrosive liquids can be metered, with minimum maintenance requirements. Corrosive products such as caustic soda, most acids, molten sulphur can be measured, provided they are metered free from air.

The new Niagara Stainless Steel Chemical Meter is made in sizes 1" DV and 2" GV with capacities from 3 to 160 GPM.

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### BUFFALO METER CO.

2893 MAIN STREET BUFFALO, N. Y. New Products, cont. . .

as against 50 blows for Grade L and 100 blows for Grade C. Another outstanding characteristic of Grade L-RF is its ability to be machined to finish to a very smooth surface. These propertics suggest many applications.

Grade L-RF is currently being produced in standard sheets, 36 x 36 in., in thicknesses ranging from 16 in. up

to and including 2 in. Thickness tolerances currently applicable to Grade L can be maintained in Grade L-RF, and closer tolerances can be attained by sanding operations. Grade L-RF is furnished in rod form in standard lengths of 36 in. and in diameters ranging from \$\frac{1}{2}\$ in. to a maximum of \$\frac{1}{2}\$ in.

Synthane Corp., Highland Ave., Oaks, Pa.



#### Coating Retards Fire

Even when hit by the intense heat and flames from a welder's torch for five minutes a plywood panel coated with Sherwin-Williams' new fire-retardant paint failed to burn and char away (above, right). Instead, the flames turned the coating into a non-burning, marshmallow-like substance that protected the wood from fire. And when part of the substance was removed the original grain of the wood was found to be unharmed by the heat and flames. When the torch was applied for the same period to a panel covered with conventional paint the wood burned and charred (above, left).

This new paint, unlike earlier fireretardant coatings, does not flake, has good resistance to moisture and adheres well to most surfaces. Developed on an experimental basis by Sherwin-Williams, it is designed for indoor uses —primarily for basement ceilings and also for aircraft interior finishes. Its use as an undercoater for house paint is hoped for but is still in the realm of research.

A powder thinned with water, the new coating resembles clear varnish in appearance. Once applied, it may then be covered with a coating of conventional paint to provide color, if wanted, without impairing its fire-retardant action.

In another test, exposure to the flames of a blowtorch for 25 min.

caused the coating to swell into an inch-thick spongy mass. The wood beneath was not even charted.

Sherwin-Williams points out that use of the new paint cannot guarantee a fireproof home. But it does give firemen another 15 to 20 min. to get a fire under control.

Temporarily known as Coating X, the new fire-retardant paint is available only for experimental purposes at present. The manufacturer is exploring further uses and conducting more exhaustive tests before making it commercially available,

Sherwin-Williams Co., 101 Prospect Ave., N.W., Cleveland, Ohio.

#### FOR WHITE ENAMELS: Phthalic Alkyd Resin

Resinous Products Division of Rohm & Haas Co. is presently producing a new and unique film-forming resin. This resin permits the paint manufacturer to formulate a non-sagging architectural white enamel without using zinc oxide, thus affording excellent color retention in both light and darkness. Obviously, such a formulation avoids the disadvantage of yellowing in the dark that is characteristic of zinc oxide.

This new and radically different resin in the phthalic alkyd class is designated as Duraplex DX-656 by the maker. Although it is a long-oil soya type, it has characteristics not

(Continued)



#### resist the attack of concentrated acid fumes

I N chemical plants, few structures under-go more severe corrosive attacks than hoods and ductwork. They are continuously exposed to highly concentrated acid fumes, which, combined with moisture and air, are often more corrosive than solutions of these materials themselves.

Fume ducts and hoods fabricated from U·S·S Stainless Steel give highly satisfactory service even when handling the concentrated fumes of hydrochloric, sulphuric, nitric, perchloric and other acids.

Superior resistance to corrosion, greater ease of cleaning, adequate structural strength with minimum weight, freedom from danger of product contamination, and high resistance to extreme temperatures . . . all these features of U·S·S Stainless Steel make it particularly suited for many types of chemical processing equipment.

U.S.S Stainless is offered in a wide variety of grades, finishes, sizes and shapes to meet every condition of use and fabrication. For the finest performance from your Stainless equipment, specify U·S·S Stainless Steel-a perfected, service-tested Stainless that is uniform in finish, composition and fabricating quality.

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES, CLEVELAND, OHIO - CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH & CHICAGO COLUMBIA STEEL COMPANY, SAN FRANCISCO - NATIONAL TUBE COMPANY, PITTSBURGH - TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM UNITED STATES STEEL SUPPLY COMPANY, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST - UNITED STATES STEEL EXPORT COMPANY, NEW YORK





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Address Department 3, C. K. Williams & Co., Easton, Pa.



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New Products, cont. . .

available in any of the other Duraplex resins.

Specifically, it is said to show much greater flexibility and film length over long aging periods than does the usual oxidizing type alkyd resin. In addition, it is said to have excellent gloss retention, fast drying speed and extremely broad compatibility—extending to a wide range of drying oils, coldcut varnish resins, varnishes, alkyd, and urea and melamine resins.

These characteristics have led to its adoption in architectural white enamels, automotive coatings, metal decorating coatings, cloth coatings and metal tube enamels. Its use is indicated in many diverse applications involving great toughness, flexibility and light color, coupled with fast airdrying or baking speed.

To take maximum advantage of the characteristics of Duraplex DX-656, a careful study of the drier combination should be made. The following combination of driers and anti-skinning agena, calculated as metal based on alkyd solids, has proved satisfactory: cobalt naphthenate 0.075 percent, manganese naphthenate 0.03 percent and anti-skinning of 0.25 percent.

and guaiacol 0.25 percent.

Many architectural vehicles are supplied at lower viscosity and consequently a higher solids content than Duraplex DX-656. These very-high-solids materials often sag on vertical surface, but, of course, have high hiding power. If very high hiding power plus freedom from sagging is desired, a blend of Duraplex DX-656 with Duraplex D-65A or with an Amberol 801 varnish may be employed.

Rohm & Haas Co., Washington Square, Philadelphia 5, Pa.

#### Maleie Esters

Three maleic esters—diethyl maleate, dibutyl maleate and di(2-ethylhexyl) maleate—are now being shipped by Carbide & Carbon Chemicals Corp. Major interest in maleic esters centers in their use as monomers for polymerization and copolymerization.

By adjusting reaction conditions and by choosing monomers judiciously, polymers can be produced that range from very brittle resins to soft, internally plasticized and readily extensible materials. In general, the lower molecular-weight esters yield the more brittle polymers, while esters of high molecular-weight alcohols tend to produce soft, flexible materials.

Polymers and copolymers of maleic esters have been used in many industrial applications. Among them: coatings, films, molded products and textile specialties.

According to Carbide, other maleic esters, such as dimethyl, diisopropyl, dihexyl and diallyl maleates, can also be produced upon reasonable notice.

Carbide & Carbon Chemicals Corp., 30 East 42nd St., New York 17, N. Y.

#### FREE-FLOWING:

#### Sodium Chloroacetate

Dow Chemical Co. at this time announces the immediate availability of technical-grade sodium chloroacetate, a free-flowing, stable powder.

A typical analysis of this product shows: 94.5 percent sodium chloroacetate, 1.5 percent sodium dichloroacetate, 0.5 percent sodium acetate, 0.5 percent sodium chloride and 3.0 percent water.

The product is available at the following prices: carload lots in 300-lb fiber drums at 20c. per lb.; less than carload lots in 300-lb. fiber drums at 21c. per lb.; and in 160-lb. fiber drums at 22c. per lb. All prices are fob. Midland, Mich.

Dow Chemical Company, Midland, Mich.

#### NON-HONIC:

#### Surface-Active Agent

Sharples Chemicals, Inc. presently is marketing Nome 218, a concentrated, liquid, non-ionic surface-active agent of the alkylene oxide adduct type. It possesses an unusual combination of detergent and wetting properties. In fact, it is seldom necessary to use more than one part of Nonic 218 in 2,000 parts of solution. This concentration gives a Draves-Clarkson sinking time of less than 25 sec. at 77 deg. F. and excellent detergency. Nonic 218 is effective over wide ranges of temperature and nH.

It is particularly useful: (1) where cationic or anionic agents are rendered inactive (salted out or neutralized); (2) in combination with either cationic or anionic agents to improve wetting, penetration and detergency; (3) where hard water conditions exist: (4) where quick and efficient removal of grease is required; (5) where cleansing and wetting action are required simultaneously; and (6) where good cmulsifying properties are required.

A straw-colored liquid with a very slight characteristic odor, Nonie 218 has a specific gravity of 1.05 at 20 deg. C. Its viscosity at 77 deg. F. is 1.33 poises. Average weight per gallon is 8.5 lb. The concentration required for 25 sec. sinking time at 77 deg. F. (Continued)

## CHEMICAL BARGES



with Built-In Savings



One fabricator, one profit—a coordinated job from blue-prints to delivery. Such were the advantages that our customer, one of America's largest and most discriminating concerns, found in choosing Ingalls to build its fleet of four new chemical barges.

The 195 ft. barges were built at our Pascagoula, Miss., and Decatur, Ala., shipyards, while the high pressure tanks were fabricated simultaneously at our Birmingham and Pascagoula plants by our subsidiary, the Birmingham Tank Co.

Each barge has a carrying capacity of 234,000 gallons. The tanks may be mounted separately or made removable in the open hopper type barge. For coastwise service and for open water on the intercoastal canals, the tanks may be installed below deck in similar tank type barges.

Let Ingalls "build-in" the profits on your next tank, barge or plate work order. Quite often, economies result from joint use of our modern fabricating facilities that can be passed on to the customer. Write, wire or telephone for information.



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The problems of leak-tight, dependable valving of most corrosive and hard-to-handle fluids can be solved with Hills-McCanna Diaphragm Valves. By using a simple pinch clamp principle wherein a resilient diaphragm is squeezed against a weir, flow is positively controlled without troublesome leakage, internally or externally. Even when handling slurries or semi-solids, the resiliency of the diaphragm permits a tight closure by conforming to the shape of particles that may become lodged in the opening. The diaphragm also serves to keep the material handled out of the working parts and likewise to prevent contamination of the material.

Hills-McCanna Diaphragm Valves are made in sizes from %" to 14" for manual, remote or automatic operation. Choice of diaphragm and body materials to meet most requirements. For pressures up to 150 psi and temperatures to 180° F. (to 220° F. under certain conditions). Ask for Catalog V-48, HILLS-McCANNA CO., 2341 W. Nelson Street, Chicago 18, Illinois.

FOR 66° Be SULPHURIC Hills-McCanna naw affars new plastic diaphragms for handling 66° Be sulphuric. Write for details.

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diaphragm valves

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by Draves-Clarkson is 0.045 percent. Surface tension of a 0.05 percent solution is 28 dynes per cm. Interfacial tension, water against mineral oil, 0.05 percent solution, is 0.0 dynes per cm.

Nonic 218 is soluble in water, ethyl alcohol, acetone acetate, ethyl ether and amyl acetate. This non-ionic surface-active agent is available commercially from Sharples.

Sharples Chemicals, Inc., 123 S. Broad St., Phila. 9, Pa.

BUILDING BLOCKS:

#### Quartet of Organies

Four new organic compounds are announced by Heyden Chemical Corp. The chemicals are anise acid, anisoyl chloride, o-chlorocinnamic acid and 4,4'-dichlorobenzophenone. As "building blocks" that have not been heretofore generally available, they will be of interest to chemists in various fields.

Most of the new compounds will be made in the versatile fine-chemicals manufacturing unit that was constructed not long ago at the Fords, N. J., plant of Heyden. These chemicals will supplement the standard products manufactured in the company's plants and will, to a large extent, be derived from them.

The anisic acid and the anisoyl chloride are already to be had in commercial quantities. All four of the new organics can be obtained in pilotplant quantities.

Heden Chemical Corp., 393 Seventh Ave., New York 1, N. Y.

FOR COATINGS:

#### Styrene Resins

Bakelite Corp. announces the commercial availability of a new class of resins, promising wide usefulness in the manufacture of surface coatings. The resins are oil-modified styrene copolymer solutions and are designated as Bakelite C-10 Resins. Two types are currently available—BJS-501 and BJS-502.

BJS-501 is particularly recommended for interior architectural finishes, such as trim and wall surfaces in homes, offices and other buildings. Air-dry enamels of exceptionally high gloss and "build" are produced. They may be applied easily by brushing and are superior to conventional enamels in resistance to fogging in interior exposure. The resin is pale in color, promoting wide color possibilities, and in addition, has good color retention, good pigment suspension and stability even with reactive pigments. Mineral spirits can be used as the sole solvent.

Enamel finishes that air-dry as fast

as lacquers can be made from Bakelight C-10 Resin BJS-502. They are already being used for toys and farm implements, where it is an advantage to be able to handle such items 8 to 10 min. after spray application.

Baking-type enamels based on BJS-502 offer great usefulness in meeting short baking cycles. For example, enamels will bake to a Walker-Steele hardness of 137 sec. in 30 min. at 250 deg. F. At 300 deg. F., such enamels bake to a hardness of 141 sec. in 20 min. BJS-502 also features good stability, suspension of pigments and color retention.

Compatibility of these resins and other pertinent data have been studied, and it is expected that these products will find wide usefulness.

Bakelite Corp., 30 East 42nd St., New York, N. Y.

#### CRYSTALLINE:

#### Dihydrostreptomycin

Heyden Chemical Corp. presently is making commercially available dihydrostreptomycin sulphate in crystalline form. This crystalline form of dihydrostreptomycin has permitted the establishment of new high standards of purity and potency. These include a minimum assay value of 725 mcgs. per mg., compared with the present 600, and less than 1 percent unreduced streptomycin sulphate, against the maximum of 3 percent heretofore established.

Heyden, long active in the development and manufacture of antibiotics, has been producing the dihydrostreptomycin since last fall. Until now, however, it had been marketed only in noncrystalline form.

The new form is readily available in adequate supply as a result of expanded production. It will be made available to hospitals and doctors at no increase in cost, according to Heyden.

Heyden Chemical Corp., 393 Seventh Ave., New York 1, N. Y.

#### NEW PRODUCERS:

#### Sodium Hydride

Metal Hydrides, Inc., announces the availability of research quantities of sodium hydride. Under arrangements recently completed with Du Pont, Metal Hydrides will manufacture and sell this product. Construction of a new plant has been started. While this plant is not yet completed, if present engineering schedules are maintained, commercial quantities of sodium hydride will be available early in the fall of this year.

Meantime, Metal Hydrides, Inc., has made available to all interested (Continued)

# Stop Costly Shutdowns Musing ILLINOIS Chemical Porcelain PIPE and FITTINGS

Acid and alkali resistant porcelain keeps liquids handling systems in constant operation—reduces production losses due to corresion, electrolysis, mineral deposits and composition changes caused by frequent replacement of pipe, valves, or fittings.



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All Illinois pipe, valves Non-absorbent Illinois and fittings are produced Chemical Porcelain has under the most exacting inherent corrosion-proof standards of quality conqualities-its supertrol. Dimensions are smooth inside surfaces accurate, ends are and strong fractureground true and smooth resistant walls make it outstandingly successful for gasket mounting and flanges are jig-assemas a chemicals handling bled. All necessary nuts medium. No rough or and bolts are furnished. pitted inner walls.

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tell you all the facts about the Kathabar System...how it will provide just the desired grains of moisture, or percent of relative humidity best suited for the specific processing application...the simplicity and dependability of the Kathabar System—proved in over 300 installations...how it can reduce and possibly eliminate refrigeration tonnage...how it works independently of temperature...how it eliminates condensation in pipe galleries and prevents frost on low temperature refrigeration coils. There are hundreds of applications in the process industries where the Kathabar System of humidity control will operate profitably.

Truly, the Kathabar System is the better way to air condition wherever humidity is a problem.

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| Have Kathabar Humidity Engineer call. No Obligation.  NAME  TITLE  COMPANY  ADDRESS. | Send booklet on Industrial and Comfort Humidity Conditioning. | The same |
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SURFACE COMBUSTION CORPORATION . TOLEDO 1, OHIO

New Products, cont . . .

parties sufficient material for development and research purposes. Technical data and information, as well as proposed shipping schedules, may be obtained by contacting Metal Hydrides in Beverly, Mass.

Metal Hydrides, Inc., 12-24 Congress St., Beverly, Mass.

#### CHIP-RESISTANT:

#### Cold-Pour Plastic

Palestic Corp., having completed development and full-scale industrial tests, is now turning out a new low-cost resin-bonded gypsum. Called Palestic, it is a cold-pour plastic, cast as readily and as rapidly as is plaster. No pressure or heat is required. Palestic is a strong, hard, durable, chipresistant material. Basically, it is a resin-bonded gypsum in which the gypsum is interlocked with the resin.

This product has been proved in large-scale shop tests that lasted more than two years. It has been found practical for the production of many industrial, novelty, art and household

Having a wide range of uses, this product is very low in cost and can be readily prepared and handled. Palestic costs about 5c. a lb.

Palestic Corp., 316 North Laflin St., Chicago 7, Ill.

#### HIGHLY BASIC:

#### Anion Exchanger

Resinous Products Division of Rohm & Haas Co. is now making Amberlite IRA-400, the new, strongly basic anion exchanger which markedly increases the scope of ion exchange technology. This is said to be the first resin absorbent which can be utilized to split neutral salts completely; that is, to convert salts to the corresponding free bases of the metallic ions.

One of the important contributions of the new anion exchanger is the direct removal of silica from feedwater for high-pressure boilers. IRA-400 will adsorb negatively charged ions from acid, neutral and even mildly alkaline solutions in a pH range from

This exchanger behaves as solid caustic with only its hydroxyl ions in solution. Its reaction as a strongly dissociated base largely explains its extraordinary exchange rate—far greater than other anion exchangers. This rapid rate of exchange is a very desirable feature where batchwise techniques are practicable.

Thus it offers new opportunities for ion exchange methods in specialty applications apart from water conditioning. For example, it adsorbs all amino acids with isoelectric points below pH 10. And in de-ashing operations, it is capable of removing the anionic impurities first—a reversal of the usual de-ionization procedure. This technique permits safe treatment of solutions that would be adversely affected by exposure to low pH.

According to the manufacturer, the resin can actually be mixed intimately with a strong cation exchanger to prepare an adsorbent bed that will completely de-ionize solutions in one column and in one step.

Resinous Products Div., Rohm & Haas Co., Philadelphia, Pa.

NON-JONIC:

#### Synthetic Detergents

Antara Products, General Aniline & Film Corp., Inc., has introduced two new non-ionic synthetic detergents. These products, Antarox A-400 and A-480, are displaying versatility at low cost in many different detergent applications.

The fact that these two new detergents of the aromatic polyethylene glycol ether type are practically odorless, says the manufacturer, makes them particularly valuable for the specialized demands made upon detergents today.

Antarox A-400 and A-480, because of their ether structure, are extremely stable in the presence of acids, alkalis and electrolytes. Because they do not ionize, they will not form insoluble compounds in hard water. They do not easily decompose or separate.

The new Antaroxes are foamers, according to Antara Products, making possible the formulation of products with consumer appeal. Their physical and chemical properties will not change over long periods of storage. They also are capable of withstanding wide variations in temperature.

Samples of Antarox A-400 and A-480, as well as complete technical information on their characteristics and applications, are available from General Aniline & Film Corp.

General Aniline & Film Corp., 444 Madison Ave., New York 22, N. Y.

LICKS BRITTLENESS:

#### Plasticizer for Urea Resins

Glyco Products Co. has come up with a plasticizer to overcome brittleness in certain urea-formaldehyde compositions. The product is Diglycol Stearate S.

Urea-formaldehyde adhesives for plywood and veneer board tend to be very brittle after they set. These adliesives are apparently quite difficult to plasticize. This has imposed great limitations on their use. Coatings

(Continued)



Here's the ultimate in accuracy of control for pressure reducing, back pressure, pressure relief, vacuum, vacuum relief, pump governor regulation or boiler fuel governor service. It is the new McAlear 1500 PILOT which reduces hysteresis to a minimum through use of a spiral sensitive spring in place of the

conventional "C" gauge spring.

The No. 1500 PILOT may be mounted either above the valve it operates or remotely on a panel (surface or flush) without alteration. No tools required for adjustment of throttling band or for conversion from direct to reverse action.

Installed with the McAlear No. 115 or 116 Diaphragm Motor Valve (left), it gives you a completely coordinated "package" for sensitivity control. Write for bulletin No. 150.

MEALEAR Mfg. Co. 1907 SOUTH WESTERN AVENUE CHICAGO 8, ILLINOIS



REPRESENTATIVES IN PRINCIPAL CITIES AN INDEPENDENT MANUFACTURER FOR



- 1040

Lawrence Process Pump

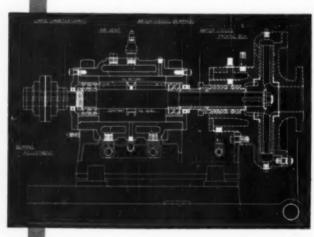


## PROCESS PUMPS for HANDLING LIQUIDS at HIGH TEMPERATURE and HIGH PRESSURE

The pumping of corrosive and/or abrasive liquids at high temperatures and pressures requires design techniques beyond the capabilities of most pump manufacturers. Lawrence engineers have specialized in this difficult field for over 80 years and can offer you the benefits of their broad experience.

Typical of Lawrence advanced engineering is the process pump illustrated, made from corrosion-resistant metals with packing box and bearing housing both water cooled. Note also the clean-cut appearance and accessibility of the principal components.

If you have a difficult pumping problem, write us the pertinent details. No obligation.





LAWRENCE

MACHINE & PUMP CORPORATION
369 MARKET STREET, LAWRENCE, MASS.

New Products, cont. . .

and impregnations of textiles and paper with urea-formaldehyde resins and compositions suffer from the same disadvantage.

Incorporation of about 2 percent Diglycol Stearate S in such products plasticizes them effectively, preventing them from becoming brittle. The bonding action is not affected. Diglycol Stearate S is a white, wax-like product having a slight agreeable fatty odor.

Glyco Products Co., 26 Court St., Brooklyn 2, N. Y.

#### Briefs . . .

Isobutyl alcohol is now in volume production at the Bishop, Tex., plant of the Celanese Corp. of America. The added production will open up new uses. Isobutyl alcohol is used in plasticizers, alkylated urea resins, esters, extractants, general solvents and brake fluids. Celanese has set the delivered price at 12½ c. a lb. in tank cars and 14 c. a lb. in carloads or drums. Celanese Corp. of America, 180 Madison Ave., New York 16, N. Y.

Phenolphthalein glucuronide, now commercially available from the Sigma Chemical Co., is vital in the study of glucuronidase activity in animals and man. Until now, its preparation involved long and elaborate procedures. With the introduction of this high-purity substrate, time can be saved on important research. Sigma Chemical Co., 4648 Easton Ave., St. Louis 13, Mo.

Betachlor, latest of Wyandotte's organics, consists of 57 percent β, β'-dichloroethyl ether and 43 percent β, β'-dichloroisopropyl ether. A solvent for oils, fats, waxes and greases, it has possibilities in extraction processes, textile processing and the formulation of cleaning compounds. It is a solvent for resins and film formers, and in intermediate in synthesizing resins. As a soil fumigant, Betachlor effectively controls insect infestation. Wyandotte Chemicals Corp., 1609 Biddle St., Wyandotte, Mich.

Stabilizers for foods and cosmetics are dehydroacetic acid and its sodium salt. Laboratory tests and field trials of DHA and DHA-S, as Dow has trademarked them, show their promise as inhibitors of the bacteria, fungi and yeasts commonly encountered in manufacturing and processing cosmetics, food and food packaging materials, and beverages. Dow Chemical Co., Midland, Mich. —End

## International FOR THE LATEST IN ENGINEERING DESIG



The engineering skill and careful production methods used in building INTERNATIONAL RIBBON MIXERS guarantee their quality and dependability - their reputation for top performance in practically every type of process production is the best possible recommendation.

No matter what type or size of Mixer your work requires, there's an INTERNATIONAL made to exactly fit your needs. Our Engineering Department will gladly cooperate in solving any difficulty. or unusual production problem.

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Here are some of the reasons INTERNATIONAL RIBBON MIXERS give Longer and more Dependable Service -

- Proper Design relation of Outer to Inner Spiral Conveyors.
- Easy Maintenance, as entire Agitator can quickly be lifted from tub.
- Heavy all-welded construction.





#### Note how Agitator Spirals can easily be taken out.

By removing the bolts from the two companion flanges, A & B, above, the entire bolted shaft assembly containing the two spirals can be lifted from the Mixer tub. Therefore, no slotted end sections in the tub are required, which sections may tend to leak dust or liquid.

SEND FOR CATALOG 1208 - showing various designs and applications, with specifications of INTERNATIONAL RIBBON MIXERS, and other Chemical Processing Equipment. Your Inquiry will receive our immediate and careful attention.





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at lower cost?

The results of over 20 years intensified Spray Drying research by Bowen is available to help you produce a better product. And facilities for testing include our standard laboratory dryer for preliminary runs and a full scale production Spray Dryer for sample lot and tonnage production.

#### BOWEN DESIGNS A COMPLETE LINE OF SPRAY DRYERS

Laboratory
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Recognized Leader in Spray Dryer Engineering ... Since 1926



#### Rotary Filter-Dryers

(Continued from page 127)

0.890. Therefore  $(V/C_r) = 237/0.890$ = 267. From Fig. 4, at  $(V/C_t) = 267$  and  $S_r = 0.238$ :  $(t/C_t) = 302$ . Time in drying zone,  $t = (270^\circ/560^\circ)$  (99) = 74.25 sec. Therefore,  $C_t = 74.25/302 = 0.246$ . Eq. (8) of last month's article gives  $C_t = \mu_L X$   $(L_{t-sep})^t/K\Delta P_{t-sep}$ : substituting in that: 0.246 = (0.512) (0.000672) (0.40) (1.027/12) $^t/(2.46 \times 10^\circ)$   $\Delta P_{t-sep}$ . From which  $\Delta P_{t-sep} = 159$  lb. ft.\* Therefore  $(\Delta P/L)_{t-sep} = (\Delta P/L)_t = (159)/(1.027/12) = 1.878/845 = 2.22$  in. Hg in. cake. From Fig. 4 of last month's article, at  $K = 2.46 \times 10^\circ$  and  $(\Delta P/L)_t = 2.22$  in Hg in. cake,  $F_t = 0.67$ . From Fig. 2 of this article, at  $(T_c + 460)/(T_c + 460) = 0.579$  and  $F_t = 0.67$ :  $(\Delta P/L)_t/(\Delta P/L)_t = 0.44$ . From which  $(\Delta P/L)_t = (2.22/0.44) = 5.04$  in. Hg/in. cake.

(6) Calculation of Vacuum Required:  $\Delta P = L_{t-arg.}(\Delta P/L)_+ + L_{t-arg.}(\Delta P/L)_5 = (1.018)(2.22) + (0.367)(5.04) = 2.25 + 1.85 = 4.10$  in. Hg,

or 289 lb./ft."

(7) Cake Deposition Zone: From Eq. (2) of last month's article,  $C_L = (\mu_L/2K_{28}) \left[ \rho'(1-s) \left( 1-X \right) - \rho s X \right] = \left[ (1.13) \left( 0.000672 \right) / (2) \left( 2.46 \times 10^{-s} \right) \left( 62.4 \right) \left( 0.2 \right) \left[ 165 \left( 1-0.2 \right) \left( 1-0.4 \right) - \left( 62.4 \right) \left( 0.2 \right) \left( 0.4 \right) \right] = 9.17 \times 10^{s} \text{ lb. sec. / ft. 'Necessary time to deposit the cake (Eq. 1, last month's article): <math>t' = C_L L^s / \Delta P = (9.17 \times 10^s) \left( 1.385/12 \right)^s / 281 = 4.33 \text{ sec. Actual time in deposition zone, } t = (30/360) \left( 99 \right) = 8.25 \text{ sec.}$  Since actual time is greater than necessary time, the desired cake thickness is controlled by the feed rate.

controlled by the feed rate. (8) Air Flow Through Cake During Dewatering:  $C_t = \mu_L X L^2 / K \Delta P = (1.13) (0.000672) (0.40) (1.385/12)^3 / (2.46 \times 10^-) (281) = 0.583$  sec;  $t = (30^\circ/360^\circ) (99) + (8.25 - 4.33) = 12.17$  sec;  $t/C_t = 12.17.0.583 = 20.9$ . From Fig. 2 of last month's article (which is an enlargement of the low-range section of this month's Fig. 4), at  $S_t = 0.238$  and  $t/C_t = 20.9$ :  $V/C_T = 11.7$ ;  $C_T = XL (\mu_L/\mu_R) = (0.40) (1.385/12) (1.13/0.0176) = 2.96 \text{ ft.}^3/\text{ft.}^2/\text{cycle: } V = 11.7C_T = (11.7) (2.96) = 34.6 \text{ ft.}^4$  air/ft. $^2$ -cycle.

= 54.6 ft.\* air/tt.\*cycle.
(9) Air Flows in CFM: Corrections to obtain air flows in cfm. at conditions at intake of blower (i.e., 4.10 in. Hg vacuum and saturated at

130 deg. F.), neglecting pressure drop in lead lines: (a) Turbulence correction from Fig. 4 of last month's article: At  $(\Delta P/L) = 4.10/1.385 = 2.96$  in. Hg/in. and  $K = 2.46 \times 10^{-4}$ 

you get  $F_* = 0.62$ . (b) Pressure correction,  $(F_*) = (\text{avg. pressure in cake})$  (inlet pressure to blower) =  $(29.92 - 0.5 \times 4.10)/(29.92 - 3.98) = 1.080$ . The cfm. to blower from cake deposition and dewatering zones = (34.6) (0.62) (1.080) (25) (60/99) = 352 cfm. Air flow in drying zone, cfm. (at 4.10 in. vac. and sat. at 130 deg. F.): Humidity (sat.) = (18.29) (4.525 in. Hg)/(25.82 - 4.525) = 0.132 lb. H<sub>0</sub>0 per lb. dry air. So cfm. = (140.2) (1.132) [359/(29 + 18 × 0.132)/1.132] (390/492) (29.92/25.82) = 2.840 cfm. Total intake to blower = 2.840 + 352 = 3.190 cfm. at 130 deg. F. and 4.10 in. Hg.

(10) Preheater for air (Direct Contact Type): Assuming volume of flue gas in exit stream to be negligible: cfm. fuel gas = (lb. air/min.) (temp. change) (spee. heat)/(net heating value of fuel gas) = (140.2) (630 – 70) (0.25)/(535) = 37.3 cfm.

#### SUMMARY

The thickness of moist portion of the cake leaving the drum of a filter-dryer should be kept above the critical moist-cake thickness for maximum drying efficiency. The critical moist-cake thickness is the thickness at which the instantaneous drying efficiency is 90 percent. Fig. 1 shows the critical moist-cake thickness as a function of cake permeability and pressure gradient. The cake may be completely dried by mixing the wet and dry portions after the cake leaves the drum.

Calculations for a filter-dryer are made by two heat balances, Eqs. (4) and (5), the first giving the thickness of the moist portion of the cake leaving the drum, and the second the amount of preheated air required. The pressure gradient across the moist portion of cake is calculated from the air flow, permeability, and a turbulence factor. The pressure drop across the dry cake is calculated from the temperatures and turbulence factor by use of Fig. 2. This gives the total pressure drop across the cake. The air flow during cake deposition and dewatering and the moisture evaporated are added to the air required for drying to obtain the total blower requirements.

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 Brownell, L. E., and Katz, D. L.,

Chem. Eng. Progress, 43, 601 (1947).
 Brownell, L. E., and Katz, D. L.,
 Chem. Eng. Progress, 43, 703 (1947).

# What?

Well, so far we call it the New "VOTATOR Centrifugal Worker and Deaerator. And so far it's slated for use as a piece of grease processing apparatus.

But—like the feller who discovered gravity and felt it was of more use than apples—we feel we've got something which may also turn out to be an excellent piece of chemical processing apparatus, cosmetic processing apparatus, soap processing apparatus, or what have you in the wide world of viscous materials!

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blends, plasticizes and emulsifies viscous materials



assures complete dispersion of ingredients



functions with low vacuum for controlled aeration



functions with high vacuum for positive deaeration



handles low viscosity materials



handles high viscosity materials



handles optimum volume in minimum space





New 100 x 350-ft. building of two, three and four story design houses the biological process for Chloromycetin, it can be used also for other antibiotics.

## Chloromycetin Production

**Biological Process** 

Article on page 107

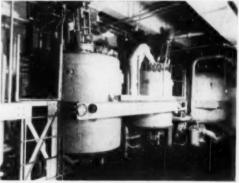
Discovery and proof of a new antibiotic, Chloromycetin, by Parke, Davis & Co. during 1947 was followed closely by the development first of a biological process for commercial production, then of a synthetic process which is portrayed on p. 112.

Seed spore, prepared in the laboratory from the parent mold, is grown in the plant, first in 50-gal, pre-seed tanks, then in larger batches in 500-gal, seed tanks, and finally in 5,000-gal, fermentation tanks, using a nutrient medium consisting of wheat glutin, glycerine, sodium carbonate and sodium chloride. Mold growth is aerobic, using sterile air under close temperature control. The resulting broth containing a very dilute solution of Chloromycetin, is then filtered, concentrated by extraction and evaporation, crystallized and recrystallized, pulverized, screened and packed for shipment.

Removal of the nycelia from the broth is accomplished in a precoated rotary pressure filter, care being taken to preserve the washings and the filter contents at the end of the rm. The clarified broth is neutralized and extracted with anyl acetate in a centrifugal countercurrent extractor, a five-to-one volume reduction. Further concentration to about 1 percent of the original batch is the result of vacuum evaporation. The concentrate is washed with acid, alkali and water, further evaporated to about 0.05 percent of original volume and refrigerated to crystallize the crude product which is dissolved in hot water, carbon treated and recrystallized prior to final filtration and drying. Pulverizing and screening complete the manufacturing operations.

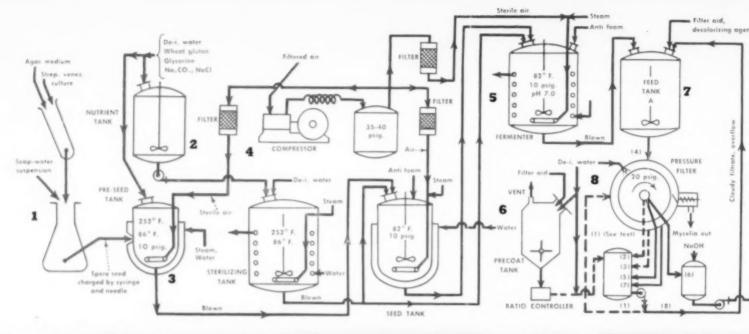


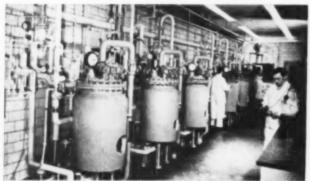
Chloromycetin production starts with propagation of the mold strain under conditions of close laboratory control.



In the plant the initial operation is the preparation of the nutrient medium from gluten, glycerine and salts.

CHEMICAL ENGINEERING \* OCTOBER 1949 \* PAGES172-175





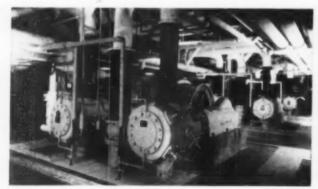
Seven 50-gal, pre-seed tanks are used to grow the seed spore received from the laboratory; completed, each tank's contents is blown to a seed tank.



Here is a 500-gal, seed tank (right) and a 5,000-gal, fermenter; seven of each are in use, turning out fermentation batches in a 76-hr, period.



Two of these 3,000-gal, tanks are u from the fermenters, as well as close



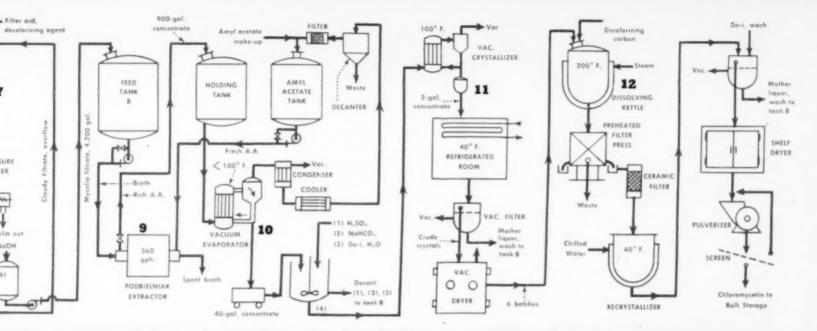
Air required for the aerobic growth of the Chloromycetin-producing mold is filtered, compressed in carbon-ring compressors, and filtered again.

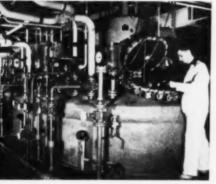


These agitated and ventilated hopper mixers in the preparation room make initial suspensions of filter aids, as well as solids for nutrient media.

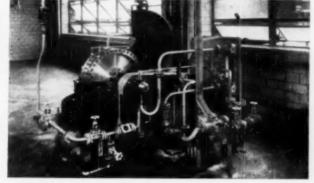


B Eliminating mycelia from the broth coat rotary filters, each having a capac

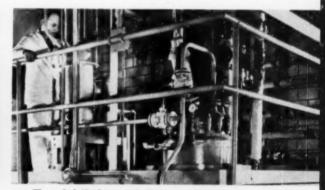




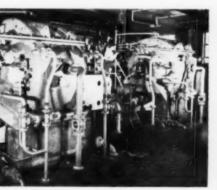
l-gal. tanks are used as filter feed tanks, receiving broth s, as well as cloudy filtrate and filter overflow.



Solution of the content of the co



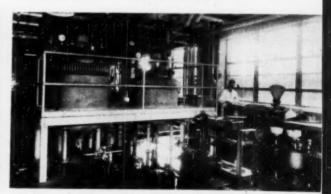
The washed 40-gal. extract, further evaporated in this glass vacuum crystallizer, yields a small volume of crude crystals.



from the broth requires filtration in two pressure preh having a capacity of 1,000 gph. at 20 psig.



10 Vacum evaporation at less than 100 deg. F. further concentrates the Chloromycetin extract to about 1 percent of the volume of the original batch.



12 Here crude Chloromycetin crystals are dissolved in water, carbon treated, filtered, recrystallized and then vacuum filtered.













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\*Specialized grades of Sodium CMC

Wyandotte Carbose, when incorporated in soaps and synthetic detergents, improves not only soil removal but also whiteness retention. In effect, it suspends the soil it removes . . . keeps that soil from redepositing.

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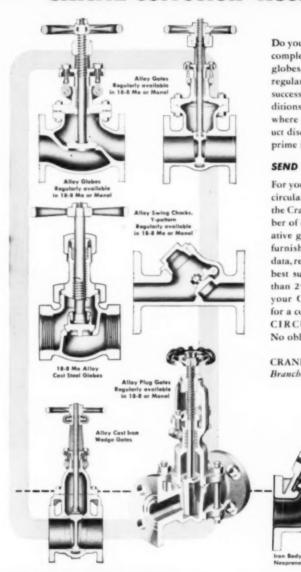
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CHEMICAL ENGINEERING—October 1949

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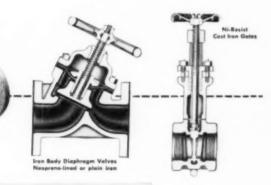
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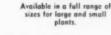
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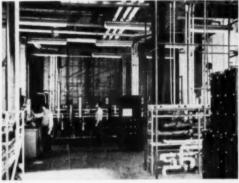


# Chemical Engineering News

IOSEPH A. O'CONNOR, Assistant Editor



New research center of Carbide & Carbon Chemicals Corp. at South Charleston, W. Va., extends over a 140-acre area.



Researchers carry on studies in organic synthesis in this largescale laboratory at Carbide's new research center.

# Carbide's New Research Center to Concentrate on Basic Research and Process Development in Organic Field

The new research center of Carbide & Carbon Chemicals Corp., one of the largest and most modern in the U.S., has just been completed by H. K. Ferguson Co. Situated on a 140-acre site near Carbide's South Charleston, W. Va., plant, the laboratories will be the center of the company's fundamental research in plasticizers, resins and organic chemicals. Process development will also be carried on at the center in four large buildings to be occupied in the future.

A three-story T-shaped structure of brick and steel, the main laboratory building is 325 ft. long and 96 ft. deep. It contains 69 individual laboratories, 48 offices, a large-scale laboratory and an auditorium that seats 125 persons.

Fourteen utilities are available at each laboratory desk. These include hot and cold water, distilled water, cold brine, fuel gas, compressed air, vacuum, nitrogen and low-pressure steam. High-pressure steam and hydrogen are provided where needed.

Highly flexible, the laboratories are laid out in sections or modules 13 ft. wide with a depth of 24 ft. The standard unit for two or three workers is thus 13 x 24 ft., and this may be doubled or tripled by increasing the length to 26 or 39 ft.

Rearrangement of laboratory units does not interfere with mechanical services or air-conditioning, which were designed to fit the basic 13-ft.

All laboratory and office space is air-conditioned and each room is provided with individual thermostatic control. Incoming air is cleaned by electrostatic precipitators and is cooled by a 600-ton refrigeration system. One laboratory is equipped to maintain constant temperature and humidity conditions the year round for research purposes.

Possibility of cross-contamination between areas has been eliminated by maintaining each laboratory at a slight negative pressure with reference to offices and corridors. Another familiar problem of the ventilating engineer— the loss of conditioned air through fume exhaust doors-was solved by providing each hood with an independent supply of clean, tempered air. When a hood is put in operation, a lever is thrown that opens the air supply ducts and doubles the

speed of the exhaust fan.

A special high-pressure laboratory, located at the rear of the site, will be used to study the behavior of chemical reactions at extreme pressures. Elab-orate precautions for the protection of operating personnel include an 18-in. reinforced concrete barrier between control stations and high-pressure

Outstanding among the physical testing equipment at the center are an electronic microscope, a mass spectrometer, a vacuum coating unit for electron-micrographs, an X-ray diffraction unit, a microdensitometer, and ultraviolet and infrared spectrometers.

A number of Carbide's products, developed by research workers who will occupy the new quarters, were used in the construction of the center. Vinylite plastics found their way into floor tile and upholstery. Electrical wiring was insulated with either vinyl or polyethylene materials.

# **Dow Gets Drop on Hurricanes** By Elaborate Warning System

The hurricane warning system and evacuation program of Dow Chemical Co., Freeport, Tex., features use of radar and a shortwave radio hookup.

Dow has barometer stations from Brownsville, Tex., to Louisiana and a radar station at Freeport. Humble Oil & Refining Co. also operates a radar station on contract at Swan's Island, La., and the O'Connor family is operating one in Victoria. Findings of these stations are all correlated with the United States Weather Bureau.

Cooperation of individual companies along the Gulf Coast and with the Weather Bureau in hurricanetracking is all important, according to A. T. Deere, Dow plant production head at Freeport.

Gulf Coast companies, Deere points out, are attempting to secure from FCC permission for a radio hookup to disseminate weather information. (Continued)

But this is being held up until a fre-

quency can be assigned.

Dow's system calls for a 12-hr. warning, at which partial shutdowns are started, then 6-hr. and 4-hr. warnings and finally shutdown, at which workers evacuate. Telephone and radio contacts have been established with which to contact evacuees in inland points to notify them when to return.

The Dow plan, explains Deere, also is the basis for the extensively workedout Red Cross disaster plan for Brazoria County, which covers hurricane warning and evacuation for all citizens.

Dow now has its own shortwave radio system, through which Houston radio stations may be reached. This assures full communication even when telephone lines are down.

# Isco Acquires Browning As California Outlet

Innis, Speiden & Co. has acquired E. S. Browning Co., San Francisco and Los Angeles, Calif. The E. S. Browning Co., which represents a large number of chemical manufacturers, will continue to operate under its own name. But it will sell, in addition to its own line, all of Innis, Speiden's chemicals, gums, waxes and insecticides.

E. A. Smith, formerly with Innis,

Speiden in New York as head of the gum department, has joined the Browning organization and will coordinate the activities of the two companies. Edgar S. Browning remains as president and general manager of the California firm.

# New Finishes Laboratory in Philadelphia for Du Pont

Construction work has started in Philadelphia on the Marshall Laboratory of E. I. du Pont de Nemours & Co., Inc., named in honor of John Marshall, director of the Chemical Division of the Fabrics & Finishes Department. To be completed late in 1950 at a cost of \$2 million, the new four-story building will replace laboratory facilities now located in three different buildings on the grounds of the Du Pont finishes plant in Philadelphia.

The Marshall Laboratory will provide facilities for 80 technical employees. Laboratory assistants, clerical and maintenance employees will bring the total staff up to about 185.

The building, of red brick, will be of functional design. It will be Lshaped, with one wing 216 ft. long and the other one 129 ft. The building will be air-conditioned. Each individual laboratory room will be provided with all services required.

Marshall Laboratory also will have

administrative offices, rooms, a library, a physics laboratory, both constant and variable temperature-humidity rooms, an analytical section, spray and oven rooms, photographic light and dark rooms, an equipment "laundry" room and a

John Marshall, who joined Du Pont in 1913, played an important role in the development of the Dulux synthetic resin enamel finishes. In 1945, when all technical activities of the Fabrics & Finishes Department were consolidated in a single Chemical Division, Marshall became its first director. In that capacity he had a key role in the planning for the new building, little suspecting that it would be named in his honor.

# Blaw-Knox Extraction Plant For Cargill at Chicago

Construction of a large soybean processing plant for Cargill, Inc., has ust been started by the Chemical Plants Division of Blaw-Knox Construction Co. The new plant will be located on the bank of the Calumet River in Chicago, next to the grain company's large storage elevators. Cargill, Inc., is one of the world's biggest grain dealers and elevator operators.

The "turnkey" award to Blaw-Knox covers the design and construction of buildings, carloading equipment, yard storage and all process facilities including meal grinding and sifting.

Included in the process equipment are a basket extractor, Lewis flaking mills, two vapor desolventizers, two pressure toasters and two deodorizers the last four items representing exclusive designs of the contractor.

Cargill's location will permit water shipments of some of the meal prodnet

Completion is expected in 1950. The project will give Cargill one of the largest soybean solvent-extraction processing plants in this country.

# Texas Chemical Executives Named to Regents Board

Top executives of the Texas chemical industry have been named by Governor Allan Shivers to the new board of regents of Lamar State College of Technology at Beaumont,

The regents board includes: Clark Barrett, assistant manager of the Orange plant of E. I. du Pont de Nemours & Co., Inc.; A. P. Beutel, vice president of Dow Chemical Co., located at Freeport; Joseph Mares, vice president of Monsanto Chemical (Continued)



SMILING PUPILS, GENIAL INSTRUCTOR

Smiling appreciatively, two chemists and a vice president get some pointers from a genial chemical engineer. The engineer, G. I. Klein, is explaining a step in the production of Victor insecticide ASP 47. Looking and listening are W. H. Woodstock, assistant chief chemist, Dr. H. Adler, chief chemist, and O. H. Raschke, vice president. All four are with Victor Chemical Works. Occasion was visit to Victor's Chicago Heights, Ill., plant. The plant trip was a feature of the company's annual sales meeting in Chicago in September.

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The new mill will produce stainless in widths of ½" to 50" inclusive, in all gauges, grades and finishes. This is important news to users of stainless steels, because with Trent Tube Company joining the organization, you can get stainless from Crucible in every form: sheets, strip, plates, bars, wire, forgings, castings and tubing. Crucible offers comprehensive data sheets and unsurpassed metallurgical service. Your inquiries are welcome.

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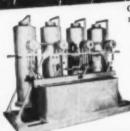
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Co., at Texas City; and Glenn H. Mc-Carthy, president of the company bearing his name.

# Huge Coker Unit to Squeeze Hydrocarbons From Fuel Oil

General Petroleum Corp. has begun construction on a \$2.25 million refinery expansion project to turn more surplus heavy fuel oil into other (Continued)

## CONVENTION CALENDAR

National Conference on Industrial Hydraulics, fifth annual meeting, Sheraton Hotel, Chicago, October 26-27.

Technical Association of the Pulp and Paper Industry, engineering conference, Statler Hotel, Boston, October 29-November 3.

Forest Products Research Society, Northcast Section, fall meeting, Hotel Statler, New York, October 31-November 1.

American Oil Chemists Society, Edgewater Beach Hotel, Chicago, October 31-November 2.

Second Pacific Chemical Exposition and Industrial Conferences, Civic Auditorium, San Francisco, November 1-5.

Society of Chemical Industry, American Section, Chemical Industry Medal meeting, Waldorf-Astoria Hotel, New York, November 4.

American Petroleum Institute, annual meeting, Stevens Hotel, Chicago, November 7-10.

American Society of Mechanical Engineers, annual meeting, Hotel Statler, New York, November 27-December 2.

American Pharmaceutical Manufacturers Association, Waldorf-Astoria Hotel, New York, November 28-30.

22nd Exposition of Chemical Industries, Grand Central Palace, New York, November 28-December 3.

Society for Experimental Stress Analysis, annual meeting, Hotel New Yorker, New York, November 30-December 2.

American Institute of Chemical Engineers, annual meeting, William Penn Hotel, Pittsburgh, Pa., December 4-7.

Synthetic Organic Chemical Manufacturers Association, annual meeting, Commodore Hotel, New York, December 7.

Society of Cosmetic Chemists, fall meeting, Savoy Plaza Hotel, New York, December 8.

American Chemical Society, Division of Industrial and Engineering Chemistry, Columbus, Ohio, December 29-30.

American Association for the Advancement of Science, Chemistry Section, annual meeting, Hotel Statler, New York, December 30-31.

First Plant Maintenance Show, Auditorium, Cleveland, January 16-19.

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News, cont. . .

petroleum products in greater demand.

The project will add more than 50 percent to the ability of the com-pany's Torrance, Calif., refinery to squeeze out the last valuable light hydrocarbons contained in the fuel oil, leaving only solid coke.

Expansion of the facilities for this secondary refining process—one for which General Petroleum already has the largest installation in the world -is particularly significant at this time.

A shift in market demands for petroleum products within the past few years has left Pacific Coast refiners with growing stocks of heavy fuel oil for which there is no apparent

While market demand for this product has slipped, demand for other products, such as gasoline, has risen. The paradox is that a refiner cannot make gasoline without making heavy fuel oil. The more of one he turns out, the more he gets of the other, since both are found in his raw material-crude oil.

With crude oil prices and other costs remaining high, and with reduced revenue coming in from the sale of heavy fuel, the drain on the working capital of the refining industry has been great.

General Petroleum first tackled this problem actually before it arose. In 1946 the company crected a "coker" refining unit in its Torrance refinery, capable of processing 15,000 bbl. a day. It is the largest unit of its kind in the world.

The current expansion project will increase the capacity of this unit over 50 percent and possibly as much as 80 percent.

Three years of experience in operating the present unit have shown that a barrel of heavy fuel oil fed into the coker unit will vield about 20 percent gasoline and about 50 percent gas oil, some petroleum gases that may be processed into liquefied petroleum gases ("bottled" gas), and about 85 lb. of coke. A large volume of dry gases (methane and ethane) is also produced.

The coke-over 600 tons daily-is carried away from the refinery in huge trucks-an unusual sight in an industry accustomed to having most of its products in fluid or gaseous form. It is used chiefly for the manufacture of

The existing unit has four huge drums, each 17 ft. in diameter and 80 ft. high, lined with stainless steel. In them the heavy fuel oil is "cooked" until only solid coke remains. Addi-

(Continued)



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News, cont. . .

tional components of the unit include a fractionating tower, furnaces, heat exchangers and de-coking equipment.

As a result of the expansion project, two more coke drums and another furnace will be added. Other parts of the existing unit are being revamped to permit them to handle the greater charge.

Design engineering for the expansion project is being done by M. W. Kellogg Co. Construction work will be done by Bechtel Co. Completion is scheduled for early 1950.

# Cold Rubber Coming From Goodyear's Houston Plant

Cold rubber is now being made in the Houston, Tex., plant of Goodyear Synthetic Rubber Corp. The plant was originally constructed in 1943 to produce GR-S rubber. Conversion of 4 of the 48 reactors to permit manufacture of cold rubber was started a vear ago.

Work was completed and regular production of the new rubber started recently. Conversion cost \$675,000.

Half of the 60,000-ton annual capacity will be used to make cold rubber. The other half will continue to turn out GR-S.

# Texas Plant Site Picked By Tennesee Eastman

Tennessee Eastman Corp. has announced plans for constructing a large plant at Longview, Tex. The plant site includes between 2,000 and 2,500 acres along the Sabine River on the Gregg-Harrison County boundary. President James C. White said that the new plant will produce basic raw materials needed for use in the Kingsport, Tenn., plant of the company.

This site was selected because of the nearness of raw materials such as oil and natural gas, the availability of a suitable water supply, satisfactory transportation facilities, high caliber manpower and good living conditions.

Local sources indicate the first unit will cost approximately \$1.5 million.

# Staley Adds New Plant for Soybean Oil Extraction

A. E. Staley Mfg. Co. has started construction of a new soybean oil extraction plant at Decatur, Ill., as part of a program for modernizing its processing facilities. The building is to be completed next July.

An addition will also be built on the (Continued)

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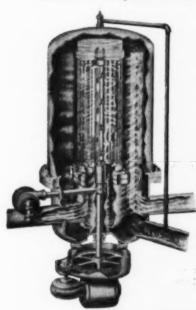
wanted solids from river water to be used in heat exchangers and process work. Spacing .015 in.\*. Filter handles 2400 gpm at 45 psi, with only 3 psi drop across the filter. (Other models handle up to 8000 gpm).



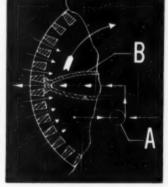
# Permanent, Non-Corrosive, Abrasive-Resistant

Filter element consists of cylindrical cage, threaded and wound with round wire. Space between wire\* allows fluid to flow inward, but stops all contaminants larger than spacing. Pressure drop is exceptionally low because fluid moves in a straight line, encountering only momentary restriction.

\*Available spacing from .0025 in. to .020 in.



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News, cont. . .

preparation building, where soybeans are made ready to go through the extraction process, and the underground storage for hexane, which is used to extract the oil from the flaked beans, will be expanded.

The new plant, which will have a rated daily capacity of 800 tons of soybeans, will be adjacent to the first plant, which has a rated capacity of 500 tons. It is estimated that the cost will be more than the \$2.5 million spent on the first soybean extraction plant completed four years ago.

Operation of the company's expeller plant will be continued for as long as possible, according to A. E. Staley, Jr., president. Conversion of the company's entire soybean processing operations to the extraction method will not increase the plant's overall capacity, but will make it possible for Staley to discontinue use of a less efficient process.

"The difference between the old and the new methods may well be the difference between full or partial émployment, and profit or loss," according to Staley. "We are using some of our savings to make this move now, so as to keep the company in a favorable competitive position." The construction contract has been awarded to H. K. Ferguson Co., Cleveland, Ohio. A contract had previously been awarded to Blaw-Knox Co. for engineering work on the new building and for supplying the principal machinery. The contract for installation of machinery is not yet awarded.

# Mississippi Attracting Chemical Industries

Chemical enterprise in Mississippi is booming. More chemical companies, and bigger ones, are moving into Mississippi all the time. This in a state whose industry was until recently based largely on her cotton and timber resources.

Although discovery of oil in Mississippi in 1939 brought in a number of petroleum companies, the state at present is witnessing the construction of three chemical plants which together will cost close to \$30 million but which are not related to petroleum.

They are: (1) International Paper Co.'s \$20 million rayon pulp mill at Natchez, which was started this year; (2) The Mississippi Chemical Corp.'s \$8 million anhydrous ammonia plant at Yazoo City, on which foundation (Continued)







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News, cont. . .

tests are being made; and (3) the acquisition by the community of Cleveland in June of the Baxter Laboratories, Inc., manufacturer of intravenous solutions and hospital administration sets, with headquarters in Morton Grove, Ill.

Bond issues, voted by local citizens under Mississippi's "balance agriculture with industry" act, were made available to each of these new industries. Under this law, known as BAWI, districts and communities in Mississippi may secure permission from the Mississippi Agricultural and Industrial Board to hold bond elections to provide funds for the purchase of sites and the construction of buildings to house new industries.

In addition to these latest acquisitions for Mississippi, the state today boasts 22 other chemical firms, exclusive of its 16 fertilizer plants and 40 cotton oil mills.

One of the largest enterprises in the petroleum field is the \$5 million recycling plant that the California Co. located near Natchez in 1948.

Two growing refineries of the Southland Oil Co., one at Yazoo City turning out gasoline and motor oils and the other at Heidelberg in south Mississippi processing asphalt and fuel oils, have been established within the past 10 years.

Since Mississippi leads the nation in tung production, many small but prosperous paint manufacturing plants are springing up throughout the southern part of the state, where tung production is high and there are mills to crush the nuts.

Behind this influx of chemical process industries are: (1) access to local markets; (2) available low-cost power; (3) abundant natural gas; and (4) numerous raw materials.

The new rayon pulp mill of International Paper, for example, will utilize Mississippi's soft and hard woods in making its product. Others drawing on the state's timber resources includes Hercules Powder Co, at Hattiesburg, Gulf Naval Stores at Gulfport and the Dixie Pine Products Co, at Hattiesburg.

In the drug field, not only is there the medical supplies business of Baxter Laboratories but also the \$1 million Phillips' Milk of Magnesia plant at Gulfport, which was established early in 1948.

Insecticides, deodorants, soaps and cleaning compounds are being made at Jackson by the Magnolia Chemical Co.; tooth paste is being manufactured on a small scale by the Iodine Products Co. of Gulfport; and F. W.

(Continued)



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A-33



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EVAPORATORS. CONCENTRATORS. CONDENSERS. FLAKERS. FILTERS.
STANDARD AND SPECIAL EQUIPMENT FOR CHEMICAL PROCESS INDUSTRIES



News, cont. . .

Fitch Co. has a big modern plant recently put up in Jackson for the manufacture of cosmetics.

Two firms, the Tri-State Linen White Co. and the Rotox Chemical Co., both of Jackson, make bleaching solutions

Bentonite from Smith County, in South Mississippi, is being used by the Filtrol Corp. of Jackson in the manufacture of acid-washed bleaching clay.

# Professor To Streamline Oldest Texas Lime Plant

A member of the chemical engineering faculty at the University of Texas in Austin, W. A. Cunningham, and 16 of his associates have purchased the Round Rock White Lime Co. The plant is located at Round Rock, Tex., made famous by the outlaw Sam Bass.

This lime plant was established in 1872 and has produced continuously since that time. It is the oldest chemical process industry plant in Texas. The site was chosen because it affords a supply of the purest limestone (better than 99 percent calcium carbonate) in the state.

Heretofore the plant has been handoperated throughout, even to crushing the limestone by sledge hammers. The new owners will modernize the plant and convert it from burning lignite to natural gas. Top quality lime will be produced for water treatment and other chemical uses.

## Briefs . .

Ethyl Corp., now in full-scale production of benzene hexachloride at its Baton Rouge, La., plant, will almost double its capacity by this fall. Already, Ethyl Corp. is the second largest producer, with Commercial Solvents the only bigger producer of hexachloride. Contract prices on the insecticide material are quoted by Ethyl Corp. on a gamma-unit basis.

Du Pont expects to put its new plant for the production of Orlon acrylic fiber into production late in 1950. The Camden, S. C., plant, first of its kind in the world, has been named in honor of Benjamin M. May, retired head of Du Pont's Rayon Department.

Pan-Am Southern Corp. is the name of the organization that results from the merger, effective September 1, of Pan American Petroleum Corp. and Root Petroleum Co. Head-(Continued) All Dressed

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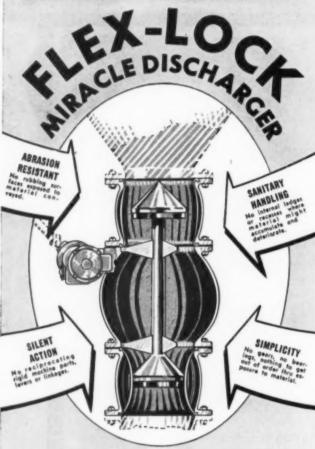
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News, cont. . .

quarters of the new corporation, a subsidiary of Standard Oil Co. (Indiana), will be in New Orleans.

General Electric Co. is setting up a third operating unit in its Chemical Dept. to handle booming business in laminated plastics. The new Laminated & Insulating Products Division will be managed by Harry K. Collins, who has been manager of the Plastics Division.

Texas Chemical & Supply Corp. has just been formed to distribute industrial chemicals and building maintenance supplies throughout Texas. E. H. Wyckoff, formerly of Diamond Alkali, is vice president and general manager. The firm, located in Houston, will handle cleaning compounds, detergents and heavy chemicals.

Corn Products Refining Co. is now running tests on the recently completed sugar refiner, final unit of its \$25 million Bluebonnet plant at Corpus Christi, Tex. This plant, the only one of Corn Products to use sorghum grains exclusively, will be formally opened this fall.

# READERS' VIEWS AND COMMENTS

## Error

To the Editor:

Sir:- I read with considerable interest the article on "Design of Thick Walled Pressure Vessel Shells" which appeared in your August issue.

I would like to call the attention of the authors to an error which appears in connection with Fig. 3 (p. 125). The authors develop Eq. 9 for the membrane analysis in which the pressure is a function of working stress and the parameter t/D, and Eq. 10 for the Lame analysis which is also a function of working stress and t/Di. They then state that "Fig. 3 shows the percentage difference between the two formulas based on the use of a material with an allowable working stress of 13,750 psi."

If one determines the error between the pressure as given by the membrane formula and the Lame formula as follows, it develops that the error is independent of the allowable working stress and is a function of the parameter t/D, alone.

Membrane formula Let  $P_M = 2S_w (t/D_t)$ 

Lame formula

 $P_L = S_{\sigma} \left[ (t/D_1)^2 + (t/D_1) \right] / \left[ (t/D_1)^2 + (t/D_1) + 1/2 \right]$ 

(Continued)



Miles of pipe and thousands of fittings went into this compact network—a complicated grease plant installation characteristic of Bechtel work in the petroleum processes.

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> Is your plant equipment as well protected? You can guard it forever against damage and down-time due to tramp iron with Dings new Alnico magnetic Perma-Pulleys and Perma-Plate Magnets . . . their magnetic permanence is guaranteed for the mechanical life of the installation.

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READERS' VIEWS, COUR. . .

The error e, in percent, is  $\epsilon = 100 (P_M - P_L)/P_L$ 

Performing the necessary operations, S<sub>w</sub> cancels out and the percent error becomes

 $e = 100 [2(t/D_1)^2 + (t/D_1)]/[(t/D_1) + 1]$ Harold Rind

Liquefaction Division Air Reduction Sales Co. Jersey City 4, N. J.

### Correction

To the Editor:

Sir:—With reference to Fig. 3, the authors wish to correct the inference that the percentage error is dependent upon the allowable working stress. If the same stress value is used in both the membrane and Lame formula, the percentage error is independent of the value of S<sub>w</sub>, since percentage error is only a function of parameter t/D. The statement that materials with different allowable working stresses will vary the percentage error slightly, is erroneous.

It was the intent to state that the total error, which designers are primarily interested in, is a function of the allowable working stress.

R. R. MACCARY Process Industries Engineers Inc. Pittsburgh, Pa.

## He's Bigger Than Me

To the Editor:

Sir:—I have just finished with a great deal of interest Chemical Engineering for the month of August, and particularly the article on the Du Pont suit (p. 189).

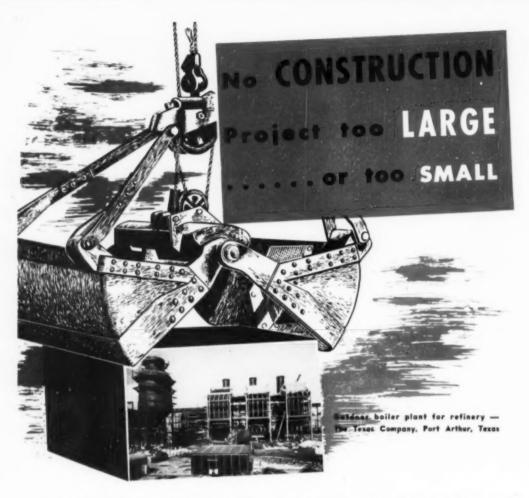
Last spring State Senator Maytag of Newton, Iowa, who is the principle owner and president of the Maytag Washing Machine, gave a talk to the Iowa Engineering Society, and in his talk he dealt with big business and the definition of big business.

He stated he had given the matter a great deal of study, thought, and attention, and had read everything he could find on the subject, and perhaps this might help out Attorney General

State Senator Maytag stated that after long study of the subject he had finally arrived at a definition, namely, that "any business was big that was bigger than his business." This interesting comment, I believe, is just about what this subject finally settles down. "Anything is big that is bigger than I am."

JOHN M. DRABELLE Iowa Electric Light and Power Co. Ccdar Rapids, Iowa
—End





To the chemical and process industry, Merritt-Chapman & Scott Corporation offers a construction service based upon years of experience in the building and equipping of pharmaceutical and chemical plants, pulp and paper mills, food processing establishments, rock products installations and metallurgical plants. A large part of this work has included the installation of mechanical equipment, piping, and processing facilities. To the company official, consultant, works executive, or plant engineer, Merritt-Chapman & Scott offers, not only wide experience in serving the chemical process industry, but the resourcefulness of skilled personnel and extraordinary construction facilities to speed the construction of your new plant or addition.

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# Men, Machines and Methods

ROGER WILLIAMS, JR., Assistant Editor



# Labor Productivity Can Be Raised, and Labor Unions Will Help if Approached Properly

Since a great portion of this issue is being devoted to cost reduction, we had better follow along. But we will limit ourselves to just one phase—cutting costs by increasing labor productivity.

Labor productivity has been much in the news recently. When the steel companies and the CIO were presenting their cases to the President's fact finding board, they got into a heated discussion of the question.

But labor productivity is simple—whether you are dealing with steel or methanol or zippers. It is merely the number of units produced, divided by the total number of man hours used. The catch is to decide what is good productivity, and what is bad.

No matter what the existing productivity of a plant is, it can always be improved. The problem, here, is to find the best way of doing it. With an assembly line, you can speed up—as UAW so often tells us. But how can the operator of a methanol converter "speed up?" In general, he can't.

Where a chemical plant is concerned there are four kinds of labor to be considered: operating labor, maintenance labor, construction labor, and overhead labor. Those four categories cover everyone from the labor gang and the office boy to the chairman of the board. We want to discuss each of them briefly.

In an existing plant, it is hard to reduce the number of operators required. For one thing, the layout of the plant when it was built dictates operators required, usually. New equipment and instrumentation can be added, but unions will not like it if it means men are laid off. Any union man will tell you he is all for "technological advance" if it means more pay for him for equal or less work. But he'll yell bloody murder if the "technological advance" means his job.

The way to cut labor requirements by introducing new equipment is to make sure that no one is laid off. This can be done in two ways. First, let normal turnover take care of it. Just don't hire replacements. Most unions will go along with this if it is explained to them. The other way assumes that your plant is expanding. Keep the men involved and use them in new units as they are built.

Unions can be helpful or harmful. Here are some excerpts from union contracts, quoted by the Department of Labor (Bulletin No. 908-10). First the ones that guarantee management's rights to technological improvements:

"It is further agreed that the employer shall have the right to install in its factory or factories during the life of this agreement any modern machinery or equipment that it may desire"

". . . the right to use improved equipment or methods shall remain with the company."

"The arbitrator shall not render decisions on the right of the company to initiate technological changes which have been initiated in accordance with the provisions of this agreement."

### UNIONS CAN FIGHT CHANGES

But don't kid yourself that there aren't unions on the other side. Sometimes unions demand participation in any proposed changes. Sometimes they want to prohibit technological changes entirely.

Here are the provisions of one agreement: "The (employer) agrees that it will not, during the life of this agreement, introduce any new processes, equipment, or machinery used as an evolution of or substitute for current . . . processes, equipment, or machinery without consent of both parties hereto, but should any strike or similar work stoppage occur during the terms of this agreement the (employer) may cancel this contract and

the above obligation as regards new processes, equipment, or machinery, shall thereupon cease."

"No labor-saving machinery shall be put into permanent operation until the union and the company have mutually agreed to the wages, hours, and working conditions pertaining to the particular device to be installed."

In dealing with operating labor, there are a couple of hidden efficiency things that are worth considering. They deal, however, with plants that are runnning 24 hours a day. 7 days a week.

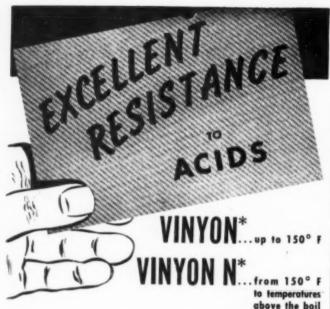
24 hours a day, 7 days a week.

The first one to consider is vacation scheduling. We can remember one plant that plotted the number of vacations taken each week during the year. The summer peak amazed them. then they began to figure how many unnecessary vacation relief men they had to carry during the off-peak months. The next year that company put on an organized program to iron out the summer peak. They were amazed at the cooperative reception. The result: a real dollar saving. You might try it yourself when vacations are scheduled at the end of this VCH.

Another thing to watch is absentecism. The payroll people can often supply a daily absentecism figure. Plotting it can give some interesting results. Compare the peaks with the opening of hunting and fishing seasons. Experience in some plants would indicate you can forecast absentecism—hence plan for it. Here again some check-ups by the medical staff can cut down the false sickness claims. Most union will actively help.

Some union contracts even specify that the union will help. Here is one quoted by the Dept. of Labor: "The union agrees to cooperate with the company and support the company's efforts to assure a full day's work on the part of employees whom it represents, and to combat actively absentecism and other practices which curtail production. . . ."

Maintenance labor is a fertile field for cost cutting—and there are several ways of doing it. One of the best is scheduling. Good scheduling of the day's work for a maintenance crew can save hundreds of man hours a month, get more work out of your craftsmen, yet not overwork them. It just means



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Rouston, Team

M M & M, cont. . .

more of their time will be productive. less just going from one job to another. The job is to balance cost savings in maintenance with perhaps more outage of equipment needing

Another fertile field in maintenance costs is standardization of jobs and equipment. Take the average plant and check the number of different makes of 50 gpm., 150 ft. head There may be a dozen or more—all requiring different types of packing or seals to be kept in stock. Mechanics have to remember the idiosyneracies of each of the dozen types. Foresight in purchasing for new plants can mean a real saving. Here is a situation where buying the pump with the cheapest quotation may mean paying and paying and paying in the future. Concentrate on a given type of equipment where possible in the different units of your plant. It will pay off in the long run. Try it and see.

## CRAFT UNIONS A PROBLEM

Well, let's turn to construction labor. Here is where any company bumps up against the long-established craft unions. So perhaps a story will illustrate the problems, and also the reasonableness of these unions. Down south, one company was building a new plant and putting up brick buildings. They found that the bricklayers had decided to lay just 200 bricks a day-no more, no less. At the wage rate involved, that made brick buildings expensive, to say the least. The company figured out that poured concrete would be cheaper unless the bricklayers could lay 800 bricks a day. The situation was put up to the brick-layers. Result: 800 bricks were laid

Although, as the above indicates, craft unions can be reasonable, these unions seem to resent technological changes. The painters are well known for this. One contract puts it this way: "Employer agrees that the use by an employee of a spray machine or gun with oil paint, or that dipping in oil paint or any other method shall be prohibited." We aren't sure about those three words "any other method." That would seem to indicate you couldn't even use paint brushes, but we'll bet the union didn't mean that.

We know this is only a brief survey of what can be done about labor productivity. But we cannot close without mentioning overhead labor. There is perhaps no better place to look for places to cut costs. Companies are just as liable to bureaucracy as governments. So a real study can show impressive savings.

October 1949—CHEMICAL ENGINEERING

# TURBINE TIPS

no. 3

question:

Are turbines a good choice in locations where conditions are tough—corrosive atmospheres, exposure to water, grit, and so on?

answer:

Yes, if the design provides proper enclosure and protection of vital parts—particularly the governor. Parts that are particularly prone to corrosion should be made of corrosion-resistant material. Turbines may be used with safety even in explosive atmospheres providing a nonsparking trip mechanism is used.



question:

What standard turbine is a good choice in such locations?

answer:

We recommend the standard DP turbine—here's why: the governor can be relied upon regardless of where the unit is installed—since the governor is completely enclosed in an oil atmosphere, is never exposed to the atmosphere. All external springs are cadmium plated to prevent rust—a standard feature. The DP is safe in explosive atmospheres—nonsparking trip mechanism is standard. Even in locations where no cooling water is available, the DP can be used with a special air-cooled oil cooler.



question:

Where can I "get the facts" when considering a turbine application?

answer:

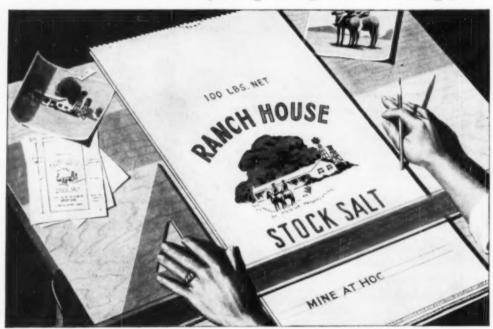
Just call or write the nearest G-E Apparatus Sales Office. Your G-E sales Engineer will gladly give you complete data on the application of turbines to your mechanical-drives—regardless of location. Apparatus Department, General Electric Company, Schenectady 5, N.Y.



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# Handling, Packaging and Shipping

R. W. LAHEY, Editorial Consultant







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# Sample Containers Combine Safety and Sales Appeal

Shipment of a sample of a product presents an opportunity to the manufacturer to impress the prospective customer with the quality of his products and the efficiency, reliability and cooperative spirit of the company. American Canamid Co. has spent over two years in developing a container for samples that takes full advantage of these opportunities.

Wide mouth glass jars for dry materials and narrow mouth bottles for liquids are closed with screw caps molded of blue Beetle resin. Liners for these caps are carefuly tested before shipments are authorized to make certain that there are no possibilities of contaminating the samples. The label, printed in the same blue color, contains necessary technical data about the sample as well as cautions to be

observed in the event the compound is hazardous. The outer shipping container is a spiral wound metal end telescope top fiber can lined with a glossy blue wrapper. The bottle is cushioned with sufficient Kimpak to absorb the contents of the container in the event of breakage.

The unique and distinctive feature of this bottle is that it can be used as a graduate both in dispensing the original contents and in reusing the bottle in the laboratory. Graduations in both fluid ounces and cubic centimeters are fused into the glass with an ink that cannot be removed by the ordinary alkaline or acid rinses commonly used for washing laboratory ware. Thus, the use of the sample is made easy and the container has a lasting use in the customer's laboratory.

# Freight Forwarders Speed Smaller Shipments

The service that freight forwarders render to shippers includes pickup of shipments, consolidation into full carload or truckload lots, transportation by rail, truck or water and upon arrival of the merchandise at destination delivery to consignee's place of business. This is accomplished by using not only their own trucking fleets in large centers but by contracting with local truckers in smaller communities and by use of rail and water transportation.

Some forwarders operate only in certain sections of the country, others handle the shipments of certain industries while still others concentrate on export shipments. They provide a through transportation service, issuing their own bills of lading, settling claims often before compensation is received from the responsible carrier, tracing shipments and billing the shipper even if several transportation services are used. Actually they assume full responsibility for shipments.

The shipper pays the less carload rate and the forwarder through his ability to consolidate shipments pays the carload rate and this difference in the rates is the forwarder's compensation for his services. Rates are filed with the ICC.

Freight forwarders through their facilities and knowledge of transportation conditions are able to speed up deliveries. They use merchandise trains which operate at high speeds on regular schedules. There are over 200 of these trains operating between Chicago and St. Louis, New York and Cleveland, Los Angeles and San Francisco, etc.

Often special equipment is used and special handling techniques developed for efficient movement of special types of merchandise. They make use of pallets and skids; road truck are sometimes equipped with elevating tail gates.

There are certain advantages that shippers may derive from these services. Deliveries may thus be speeded up to the point that express, postal and even air shipments can be dispensed with. C.O.D. service is available, the forwarder remits direct to the shipper without awaiting collection.



Down through the years DRACCO Dust Control has saved an enormous amount of money for hundreds of firms. It has been our policy to apply to each installation the "know-how" accumulated over many years. The result has been that DRACCO Dust Control each year, is saving millions of dollars. In many installations where recovery of valuables is a factor the savings have been very large. If you have dust, even in small amounts, DRACCO Dust Control will save you money. Have DRACCO Engineers analyze your dust problem — they have saved money for many.

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PNEUMATIC CONVEYORS • METAL FABRICATION

PACKAGING, cont. . .

tion from the consignee. The flexibility of this type of service is such that deliveries can be made at times that are convenient for consignees. Also, simultaneous deliveries can be made at many receiving points.

## Construction Materials for Tank Car Valves

The material specification for trim on safety valves, angle valves, check valves and sampling line valves used on pressure tank cars, listed by commodity, are as follows:

Acrylonitrile
Alcohols with high vapor pressures
Acetaldehyde
Acetone
Ethyl Chloride
Ethyl Chloride
Ethylen Chloride
Ethylen Chloride
Ethylen Chloride
Ethylen Chloride
Ethylen Chloride
Ethylen Chloride
Ammonia Ing Solution
Methyl Bromide
Methyl Chloride
Holy Chloride
Tetracthyl Lond
Tin Tetrachloride, Anhydrous
Ammonia (Anhydrous)
Nitrosyl Chloride
Carbon Dioxide (Hould)
Sulphur Trioxide
Sulphur Dioxide (Hould)
Sulphur Trioxide
Hydrofluoric Acid, Anhydrous
Chlorine (Hquid)
Bromine (Hquid)

ALSL Type 304 Free machining Type 303 grade and hardenable grade Stainless W may be substituted service conditions and fabrication procedures make it advisable. Type 303 and Stainless W, in general, have somewhat infector corrosion resistance to that of Type 304. The hardenable grade K Monel may be substituted where it seems advisionable to the service of the serv

When materials other than those listed are specified as trim, they are to be considered as special fittings.

Stamping Identification

| Material | Identification | Plain Carbon | Stel | STL | STL | AISI | Type numbers | Such as 304, 303, 416, etc. | Monel | M | Nickel | Ni | Inconel | Hastelloy | H- c

The Tank Car Committee of the M.C.A. in cooperation with tank car builders has prepared the above table of recommended materials of fabrication for valves for high pressure tank cars.

# **Duraglas Research Center**

It is the avowed purpose of the Owens Illinois glass container research center at Toledo, Ohio, to make the use of their products more practical, more economical, and more profitable for their customers. The facilities of the laboratory are freely offered to (Continued)

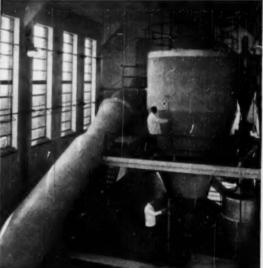
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The Swenson spray drying plant is part of the modern Swenson Spray Drying Laboratory (near Chicago). It contains the latest equipment and automatic controls for spray drying.

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# INFORMATION NEEDED

To enable us to make reliable estimates of spray drying time and cost, kindly supply the following data:

- 1. Material to be dried.....
- 2. Concentration
- 3. Volume
- 4. Remarks

Title\_

Address



# **BEAUMONT "Vibro" Automatic Weighing Scales**

NOT only speed and savings, but also a more uniform product is assured through the use of a Beaumont "Vibro" scale for the automatic weighing of bulk materials. In processes where exact weights of materials are important for "batches that match", let a "Vibro" scale do the job. The Beaumont "Vibro" scale has no belts, pulleys or motors—a stainless steel vibrating feeder eliminates moving parts and their faults. This design is particularly well adapted to very abrasive materials—and rate of feed can be easily adjusted by a rheostat controlling the vibration of the feeder. Other features include: high weighing accuracy, feeder capacity from 1 to 30 tons per hour, dust proof construction, quiet operation and long life—and we can promise prompt shipment.





PACKAGING, cont. . .

their customers for solving glass container problems.

The services include developing new shapes for specific uses and even designing of labels, shelf boxes and shipping cases. Caps and liners for bottles and jars are chosen from results of standardized tests. The group is equipped to design conveying, bottling and capping equipment if standard machinery is not available.

The laboratory regularly determines the strength characteristics of their ware by a variety of tests which includes hydrostatic, hydrodynamic, impact, and several types of rough handling tests as well as by polariscopic examination. The ability of shipping containers to protect glass bottles from transportation and handling abuses is determined by such standard tests as dropping, revolving drum, Conbur impact, compression, and vibration.

This laboratory is well equipped both as to skilled personnel and equipment to solve problems of packaging in glass.



# Paper Bags on Paper Pallet

International Paper Co. palletizes multiwall paper shipping sacks to reduce handling costs. They use four way entry, expendable paper pallets. Bags are secured to pallets with steel strapping and where required the unit load is covered with kraft paper to prevent soiling.

## Briefs .....

William B. Carter has joined the MCA Washington office staff as assistant to the Secretary. He is a graduate of Vanderbilt University with 14 years of engineering experience in the chemical industry. Mr. Carter's duties will include technical committee and statistical work.

-End

# 

identified by the blue ban

# FOR WORKERS'

- Safety
- Health
- Comfort
- · Efficiency

# VANO Design "A" VENTILATOR



Vano Design "A" cooling interior of furnace, supplying fresh air through 10 feet of "Ventube" to provide safety and comfort during









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Vantilator supply-ing fresh air to men working in wing compart-



Powered by a ½ hp motor, and equipped with the exclusive Coppus axial-flow propellertype fan, this general-purpose blower delivers 1500 CFM of fresh air. It supplies ventilation for tanks, tank cars, drums, vats, underground cable manholes, pipe galleries, airplane wing compartments and fuselages, and other confined places. Weighs only 103 lbs. Uses 8"-diameter flexible canvas tubing ("Ventube").



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For withdrawing welding fumes from confined places or directly from the welding rod ... or for expelling fumes or hat gir from enclosed vessels. You can get it with 8" suction inlet for 8" non-collapsible tubing ... or with multiple inlet nazzles for 5", 4" or 3" suction hose. The discharge outlet takes 8" "Ventube". Powered by a 1/2 hp motor, it weight only 85 lbs.

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- in tanks, tank cars, drums, etc.
- in underground cable manholes. in aeroplane fuselages, wings, etc.
- on coke ovens.
- on oteam-insted rubber processes.
  on boiler repair jobs.
  COOLING:
  motors, generators, switchboards.
- general man cooling.
  around cracking stills
- O exhausting welding

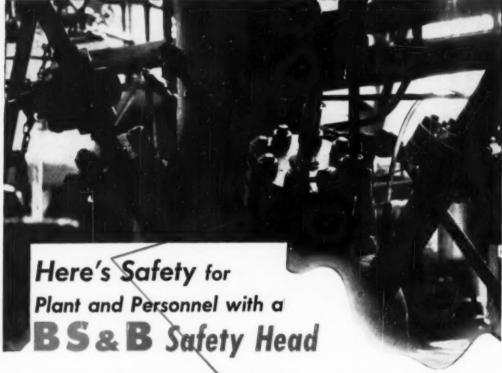
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COMPANY ADDRESS

CITY.

(Write here any special ventilating problem you may have.)

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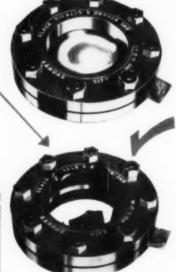


The Black, Sivalls & Bryson SAFATY HEAD is a pressure relief device consisting of pre-formed metal rupture disc, held between specially designed base and holddown flanges.

The SAFETY HEAD rupture disc bursts a predetermined pressure and temperature, affording instant, full-diameter relief. The burst rupture disis quickly and easily replaced with a new one, and the SAFETY HEAD continues to serve you in its capacity of "watchman" over the well-being of your personnel and the security of your plant and equipment.

For further information, write to Special Products Division, Black, Sivalls & Bryson, Inc., Power & Light Bldg., Kansas City 6, Mo. Use coupon below:





# News From Abroad

SPECIAL CORRESPONDENCE

# New Oil Refinery to Be Built in Puerto Rico

San Juan—Lyford and Eberle, construction engineers, New York, will construct the first oil refinery near the city of Ponce, Puerto Rico, with an annual capacity of 25,000 bbl., costing approximately \$20,000,000.

The new refinery will be operated by The Puerto Rico Oil Refining Co., a new corporation with offices at Ponce. Crude oil will be imported from Venezuela and other Caribbean oil producing countries. Parsons, Brinckerhoff, Hall and McDonald, of New York will be in charge of the engineering works of this project.

The new corporation registered at the Executive Secretary's office in San Juan, is composed of the following officials: Raul Roig, Pedro Luis Vivas, and Jose Gullermo Vivas, all of Ponce.

# Pakistan May Make Paper From Native Bamboo

Karachi—Swedish and Canadian consultants have been retained by the Dominion government to prepare a project survey covering the establishment of a 100-ton-a-day paper mill at Karachi, Pakistan, based on the vast bamboo jungles of the Chittagong Hill Tracts of Eastern Pakistan.

Preliminary studies indicate such a plant could be put into operation at a cost of about \$18,000,000 within three years from finalization of specifications. At present Pakistan has no indigenous paper industry.

# Royal Dutch New Plants Opened in Holland

Amsterdam—The Royal Dutch synthetic soap and plastics factories at Pernis near Rotterdam, Holland, were officially opened on September 2. The entire Pernis plant, including its refinery, occupies an area of 1,200 acres. In the postwar expansion of the refinery and the building of the two factories the company has invested \$64,600,000-\$76,000,000. Tank installations have a capacity of 1,000,000 tons, and another 400,000 tons are under construction.

Further expansion, due for com-

pletion by 1952, includes: a distillation unit of 6,000 tons a day; a vacuum distillation; a large catalytic cracking installation; a reforming unit; and two polymerisators. The expansion program is already under way.

# Australia Will Have New Plant for Plastics

Sydney—At a recent meeting to discuss the advisability of placing an import duty on shipments of plastics into Australia, it was announced that a £ A 2,000,000 project to manufacture plastics in Australia is planned by the Colonial Sugar Refinery Chemicals Ltd. The only detailed information given was that the company was a subsidiary of the Colonial Sugar Refinery Co., Ltd.; that £90,000 already has been spent on preliminary work; and that so far as possible, the plastics would be made from native raw materials.

# Imperial Oil Co. Seeks To Extend Pipeline

Ottawa—A large portion of Alberta oil may be refined and consumed in Ontario instead of the United States, according to an application of Imperial Oil Co., Ltd., which will be heard here soon before the Board of Transport Commissioners, with the Imperial Oil seeking approval of its application for continuation of its \$100,000,000 pipeline from Regina to Gretna. Manitoba. Already the board has approved building of the first stage of the pipeline from Edmonton to Regina.

It is understood here that instead of the Imperial Oil shipping direct to the U. S. in a swap for U. S. oil from Illinois and mid-continent fields to Sarnia, that Imperial Oil's Alberta crude oil will be piped to Gretna, then



shipped to Duluth, Minn., for transshipment to Sarnia on the Great Lakes.

# Interchemical Corp. Will Aid Australian Firm

Melbourne—A local firm, Sidney Cooke Ltd., has entered into an agreement with Interchemical Corp., New York, under which a subsidiary company will be incorporated in Australia to manufacture under license the complete range of specialty printing inks made by the American concern. The company will operate as Sidney Cooke (Printing Inks) Pty. Ltd.

Interchemical is a manufacturer of chemical coatings for protective and decorative purposes. It will make available to the new Australian firm its technical know-how and share with it the fruits of future research.

# Haifa Has Fertilizer Plant in Operation

Israel will reduce its imports of fertilizers and basic chemicals by millions of dollars annually through a new company recently established near Haifa, the only one of its kind in the country, according to Robert Szold, board chairman of the Palestine Economic Corp., American development company operating in Israel.

The firm, Fertilizers and Chemicals, Ltd., in which the corporation is a leading advisor and investor, represents to date an investment of \$1,500,000, Mr. Szold said. Expansion plans calling for the addition of a mixed fertilizer plant will require about \$3,000,000 more for buildings and equipment. This plant will be able to supply all of Israel's fertilizer needs.

To cover part of the additional facilities an application has been made for an allocation from the \$100,000,000 loan recently granted Israel by the U.S. Export-Import Bank.

After more than 18 months' preparation and construction, Fertilizers and Chemicals, Ltd., has begun operations with a daily output of 55 tons of superphosphate and 25 tons of sulphuric acid. The buildings and (Continued)



Foreign News, cont. . .

outdoor installations are located on a 90-acre site about 11 miles from Haifa. Negotiations were recently started in this country for the purchase of \$220,000 worth of new equipment.

Raw materials are now being imported, but eventually some will come from the Dead Sea when Palestine Potash, Ltd., resumes its work there. This company in which the Palestine Economic Corp. is also an investor, has a concession for extracing the vast chemical deposits in the Dead Sea. Operations, halted by the Arab war, are expected to be resumed soon on an enlarged scale. A blueprint for this work is being prepared by the Chemical Construction Co., of New York.

## Salt Production in India Below Needs

Bombay—Proposals for the modemization of India's salt manufacturing industry are being prepared by an official committee which has just surveyed production and demand and found domestic use to be careless and wasteful.

The survey showed that India produced 2.6 million short tons of salt last year compared with 2 million tons in 1947, but that imports to meet the gap between supply and demand continue at about 400,000 tons a year. Taking India's population at 330 million, this puts the annual per capita consumption at more than 18 lb., far more than required by standard dietary requirements.

In view of the shortage, salt imports from soft currency areas are freely permitted subject to a landed cost ceiling of 78 c. per 100 lb.

# Record Output of Lime In Canada Last Year

Ottawa-Canadian production of lime in 1948 reached an all-time high of 1,053,600 tons, showing an increase of 7.8 percent over the previous high of 977,400 tons in 1947, the Canadian Government discloses, adding that the value of the 1948 output was \$10,655,100 compared with \$8,542,500 in the preceding year, an advance of 24.7 percent.

Of the quicklime produced in 1948, the report shows 785,100 tons were used for chemical and industrial purposes, and 65,000 tons for building and other uses. Hydrated lime used in chemical and industrial plants amounts to 96,800 tons and the building and agricultural trades purchased

106,800 tons. It is estimated that 1,-792,700 tons of limestone were burned for the production of lime in 1948.

There were 42 establishments in operation in 1948 employing 1,121 persons who received \$2,459,300 in salaries and wages. Cost of fuel and electricity amounted to \$3,117,700 and cost of process supplies and containers \$672,600.

# Rubberized Leather Made By Melbourne Firm

Melbourne—Rubberized leather, a new shoe-making material, has gone into commercial production in Australia under an English license. It is made by the Melbourne rubber firm, Kenworth Australia Ltd. The material is known as Revitan and comes in two versions—R99 and R220. The manufacture involves teasing scrap leather into fibers and rebonding them with rubber latex. R99 is used for shoe insoles and midsoles while R220 is made for heavy duty uses.

## Aussies Plan Tariff Wall On Plastics

Melbourne—Alarmed over increasing British and other foreign competition for the Australian market, domestic producers of formaldehyde and of plastics have made application to the Commonwealth Tariff Board for a revision of import duties. Hearings started in Melbourne late in July.

Some of the applicants are subsidiaries of English and American chemical concerns. Though Australian production is not sufficient to meet mounting demand for plastics, it is alleged that competition from low-cost foreign plants threaten to stifle the industry.

Under the present tariff classification it would be impossible to increase duties without raising the landed cost of some materials which are not produced in Australia and are therefore not object of the application. The tariff board may, however, recommend a reclassification with various rates of duty on different items.

Of all plastics now covered by a single tariff item, only the phenol, cresol, xylenol and resorcinol condensation products with aldehydes are produced domestically in appreciable quantities. Production of melamine plastics has just started. A third new tariff item may possibly cover vinyl chloride, vinylidene chloride, vinyl esters and vinyl ethers in any of (Continued).

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IS AVAILABLE TO CHEMISTS INTERESTED IN

# AROMATIC INDUSTRIAL SOLVENTS



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## F Electrically Heated Process Kettle

Designed for the higher temperature ranges while ordering a wide variation in speed, low speed to provide sufficient torque when melting solids with a selection of higher speeds for efficient agitation after material has attained lower viscosities. Unit furnished complete with automatic controls and insulated jacket.



## G Cone Bottom Mixer

The Patterson Cone Type Mixer is suitable for use as a wash tank or for mixing operations requiring provision for the settling of solids or the removal of sludge.



# H Reactor with Coil, Draft Tube and Propeller

The errangement of propeller and draft tubes provides a relatively high velocity of mixture across the coil surface, assuring maximum heat transfer rate far either heating or cooling. Coil permits economically the use of high pressure steam.



# I Fully Jacketed Mixer with Gate Agitator

Primarily used for the mixing of pastes. The paddles may be vertical or horizontel—with or without stationary blades, depending on the specific duty.



J Jacketed Kettle with Scraping Agitator
When processing heavier liquids or
pastes which might cake or burn due to
local overheating and when adequate
heat transfer has to be maintained under
those conditions, a positive scraping
type agitator is indicated.

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| 20 La |          |        |        |              |     |           |

FOREIGN NEWS, cont. .

their polymerized and copolymerized forms, none of which are in commercial production in Australia.

Another subdivision may be recommended to apply different triff rates to intermediate materials and powders, and to sheets, blocks, rods and other preformed shapes. Another question to be considered by the Tariff Board will be whether synthetic resins and preparations containing synthetic resins of a type mainly used in the production of paints, enamels and varnishes should continue to be admitted under the present low tariff.

# Courtaulds Plans Rayon Plant Near Newcastle

Canberra—The English rayon firm of Courtaulds Limited has decided to establish a plant at Tomago, near Newcastle, New South Wales. It will invest \$20 million mitially, but may double the amount later. The Australian government has been assured that this does not involve any dollar expenditure because all equipment and know-how will be supplied by Britain. However, realization of the project will depend on the ability of English engineering firms to deliver the equipment. Therefore, no definite date for commencement of construction can be set.

Courtaulds will concentrate on rayon tire cord. Plims also include the manufacture of rayon yarn for 35, 000,000 yd. of fabric. Australia's total requirements are 50,000,000 yd. a year, but Courtaulds is awaiting the outcome of competitive projects, including one in conjunction with Oscar Kohorn & Co. Ltd., New York, before it nails itself down to a larger volume of filament production.

Courtaulds has been in the news with substantially similar plans since 1939, but has never made a definite decision as to location and capacity. In the last three years some announcement has appeared at least once a month in the Australian press. Anxious to get some steam behind rayon filament production, the Department of Postwar Reconstruction recently invited Ralph von Kohorn, one of Oscar Kohorn's vice president, to examine the position firsthand. The result was the establishment of a company with a small nominal capital, but with powerful textile interests behind it, for the purpose of establishing an Australian-owned rayon plant with Kohorn's engineering assistance. However, a decision on this project is also hanging fire.

(Continued)



This 2800-horsepower installation of Ingersoll-Rand Class PRE Compressors generates the Air Power for one of America's outstanding metal mines. It is typical of thousands of similar heavy-duty compressors that are so essential in practically every industry.

Whether they supply Air Power for Air Tools in factory, mine, or construction work, or compress hazardous gases at extremely high pressure in a costly process, the purchaser must rely upon the experience and judgment of the manufacturer for a dependable compressor that meets his specific requirements. To make sure you get the best, select an Ingersoll-Rand Compressor...backed by Suppralues

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Range of sizes . . . with standardized frames, running gears and interchangeable cylinders ... plus special cylinders, valves and coolers for special applications.

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#### Swiss Chemical Exports Adversely Affected By Outside Bilateral Trade Agreements

Basel-Growing world trade restrictions are threatening to throttle the Swiss chemical industry. The postwar boom is fading and the industry is fighting to hold its place in a contracting world market. This is a life and death fight, for the industry must import nearly all its raw materials; export 90 percent of its total output to

pay the bill.

The rate of new orders is off about 20 percent from last year's peak and backlogs have shriveled to a year or less in many lines. Foreign customers still would like to buy Swiss chemical specialties. But they have less and less hard currency with which to pay for imported chemicals; are tending to turn toward substitute, high-cost domestic sources of supply which are springing up rapidly in many parts of the world to answer this demand

Two world wars have sponged up the savings of many of the nations which were the Swiss chemical industry's best prewar customers. Western European nations were particularly hard hit. They have tried to protect their slim monetary reserves with currency controls, import quotas, import licenses, and bilateral trade and pay-

ments agreements.

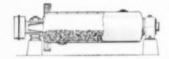
These measures have been partially successful in protecting monetary reserves. But they have restricted the volume of trade between Western nations. They have encouraged national economic self-sufficiency by acting in directly as shields for inefficient do-mestic industries. Worst of all, they have shut competition out of the world marketplace. Prices become irrelevant when commercial exchanges are negotiated between governments and tied sales are the rule. And by eliminating competition bilateral trading sharply reduces the chances of the economies involved getting on a sound paying basis by increasing productivity.

The Swiss chemical industry, as the country's third largest export industry after watchmaking and the machine industry, will be very hard hit if the Western World fails to free its trade channels of the rank growth of government controls which is blocking them today. Leaders of the industry are hoping against hope that Paul

(Continued)

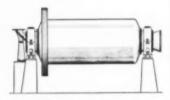


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But this is only the first savings factor in controlled atmosphere processing with modern Gas-fired furnaces. Other factors include:

- reduction in amount of material tied-up in process
- absolute quality control of resulting product
- elimination of packing operation

- improvement in physical properties averaging 30% due to exact control
- control of malleableizing cycle to conform to production requirements

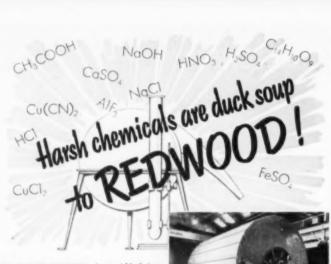
Important advantages, these—each a cost-control factor in the manufacture of Walworth valves, pipe-fittings, malleable castings.

Throughout industry you'll find examples of the economic advantages of GAS and modern Gas Equipment as important as those at Walworth Company. Efficient utilization of GAS in modern heat-processing is worthy of the continuous study your Gas Company Representative will help you make. Call him soon.



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rates gold-bearing solution from waste mud, after which gold is recovered by precipitation. Redwood is used for the drum's shell and

grids, because of its light weight, low shrink-

age, and ability to withstand various chemicals.

PAUL BUNYAN PIPEL A section of California Oregon Power Company's new Redwood pipeline at the Tokete Hydro-Electric Plant

in Oregon. With a 12-foot inside diameter, the line will curve for all but 600 of its 1645-foot length. For a flexible, low-cost, decay-resistant pipe, the natural choice was Redwood 300,000 board feet of it!

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Perhaps YOUR solution handling peoblem is "duck scap" to Redwood, too. Why not check and use Engineering data available on many uses of Redwood, including

#### REDWOOD TANKS FOR:

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FOREIGN NEWS, conf. . .

Hoffman's Economic Cooperation Administration will succeed in goading at least the Marshall Nations into libcratizing their trade policies before the end of the Marshall Plan.

So far facre aren't many encouraging signs that this hope will material ize. And until now the ERP has hurt the Swiss chemical business more than it's help d it. It's done this in two ways: It has steered intra-European trade around Switzerland who is not a participant in the clearing system set up under the Marshall Plan; and it has financed competing chemical industries in various Marshall Nations which have been able to take advantage of present trade restrictions to move into former Swiss markets.

Swiss trade in chemicals with the United States is relatively free from the hindrances it encounters in Europe, Some U.S. tariffs and import formalities hurt certain lines of Swiss chemicals, but by and large leaders of the industry feel confident that their products can eventually hurdle any reasonable tariff. Swiss importers of chemicals on the other hand, complain bitterly about the letters of credit which many American exporters have demanded since the war. They say this method of paying not only is time consuming but it ties up large sums of capital unproductively for long periods of time.

Industry leaders are confident, however, despite these difficulties, of the ability of their industry to survive and prosper provided world trade can be freed even as much as it was before the war. They point out that the in-dustry has the following natural advantages over its rivals: It has all the capital it needs to finance research and judicious expansion. All of Switzerland's big chemical concerns have been self-financing for years; are solid as banks financially. This is particularly important for the Swiss industry which must compensate for its small output by developing highly specialized quality products. That means

whopping research costs, The industry is extremely flexible since it doesn't operate on a mass production basis in the U.S. sense of the term. It can shift its production schedules fast with shifting world demand and develop products more nearly suited to the needs of individual clients. It has probably the most complex, and highly developed international sales and publicity organizations of any chemical industry in the world since Germany was sent back to first base. It can draw on a pool of extremely highly skilled workers and technicians. The high educa-

(Continued)



Millions of pounds of glycerine flow into the manufacture of alkyd resins yearly—satisfying the buge demand which has continued since World War II.

Because synthetic resins (most of which are glycerine alkyds) have made it possible to produce lacquers that are non-chipping or cracking . . . non-brittle . . rapid drying . . . and light colored—they have been designated "the penicillin of the furniture industry" by one executive? Furthermore, because solutions of alkyd resins can be easily emulsified and because they form insoluble, durable films, they have become an invaluable ingredient in interior wall coatings. And—extensive research has indicated that they will play an impor-

For sheer versatility, glycerine's combination of physical and chemical properties can be matched by no other product! That's why—for dependable performance in over 1500 industrial applications—Nothing takes the place of glycerine!

tant part in the solventless coating compositions of tomorrow.

#### GLYCERINE PRODUCERS' ASSOCIATION

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## Technical GLYCERINE NEWS

"CRACK-FILLING" COMPOSITIONS rely heavily on glycerine and its derivatives. Described as "highly satisfactory" is a typical formula containing rosin solution, glycerine, butyl alcohol, whiting, wood flour and dope. One of the best known crack-filling products contains ester gum which is made by reacting rosin with glycerine. (R-14)

FAST DRYING SPEED, HIGH GLOSS, GREAT DURABILITY and excellent color are qualities claimed for a new oxidizing type phthalic alkyd resin. The new resin is designed to meet the stringent requirements demanded of paint vehicles in the countless hody repair shops, paint shops and garages where winter temperatures often fall below the optimum. Enamels formulated with this resin are fast drying—applicable to farm implements, gasoline pumps, metal signs and other surfaces requiring repainting. (R-15)

NOVEL COATING COMPOSITION said to be capable of forming a rawhide-like covering is described by J. A. Schroeder in Canadian Patent 452,428. The formula consists of glue (from rawhide), invert sugar, glycerine, phenol and safrole. Copies may be obtained by writing the Canadian Patent Office, Ottawa, Canada.

GLYCERINE SECTIONS OF BELISTEIN TRANS-LATED! Now available for the first time, an English translation of the Glycerine Sections of Belistein's famous Handbuch der Organischen Chemie (4th Edition). Complete in one volume entitled "GLYCERINE AND SOME GLYCERINE DE-BUYATIVES."

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FOREIGN NEWS, cont. . .

tional qualifications of Swiss workers and technicians and their industry, patience and ingenuity are world renown.

It has a hard currency with which to pay for its essential imports of raw materials. It generally has had bold, and imaginative leaders seasoned by the dangers and dilemmas of foreign trading. Directors of the industry travel a lot following world market developments personally. They think nothing of flying to Rio, or New York, or Bangkok on an hour's notice.

Those are the weapons with which the Swiss chemical industry will fight its world trade battles. They are trusty, time-tried weapons. But leaders of the industry know that no matter how effective they may be the final outcome of the struggle to free Western trade from crippling restrictions will be decided in Washington, London, and Paris, not Basel or Berne. That's why they are looking to the leaders of the American chemical industry for support in the battle for a free world marketplace without which they doubt that free enterprise can survive even in the U.S. They're sure it couldn't survive long in Switzer-

#### EXPORTS HOLD UP

So much for the future of the Swiss chemical industry. The present and immediate past present a brighter picture. Exports still haven't felt the impact of declining orders and last year's figures hit new highs. There was a decrease, however, in exports of the electrochemical and electrometallurgical industry which was particularly marked for hydrogen peroxide, chlorates and peroxide salts.

The aluminum and light metal industry, on the other hand, held production at 1947 levels. Domestic sales were good and exports increased, although remaining less than prewar. The magnesium industry, however, still is limping badly. The ferro-alloys and abrasives industry increased production and sales reflecting the unabated prosperity of the iron and machine industry.

Production of phosphoric acid and superphosphates edged up. But Swiss superphosphates are bucking stiff competition on the domestic market from heavy imports of Thomas slag and foreign superphosphates. A series of derivatives of pure and chemically pure phosphoric have recently been put on the market, notably salts for dietetic supplements, medicaments, and soluble fertilizers. Principal exports so far have been filter materials and other supplies for water purification plants.

The carbide industry moved into the export market for the first time since the war last year. Domestic sales for welding also increased. But both domestic and foreign sales of carbide and acetylene derivatives sagged.

Output of nitrogen from ammonia and carbide was held at 1947 high levels by increased exports which compensated for new drops in domestic demand last year.

The plastics industry has run into stiffening buyer-resistance which has sapped the demand for methanol, formaldehyde, and urea.

The pharmaceutical industry had an uneven year last year. Exporters faced growing complications in the world market which kept the industry constantly shifting its plans. The raw materials market generally was steadier and more predictable than the year before. Raw materials were in adequate supply quantitatively, and fears that the Marshall Plan might create new shortages didnt materialize. The U.S. easily held its place as number one supplier of the Swiss pharmaceutical industry. Overall demand for Swiss pharmaceuticals continued strong last year. But growing payments difficulties in international trade stifled an important part of this demand.

Increased exports of coal-tar dves both in quantity and value made 1948 a good year over-all for the dye industry. Raw materials bottlenecks also were eased or eliminated. But Swiss dves bumped into major and sometimes unsurmountable obstacles in a number of traditional export markets notably in Europe. Fears are expressed in the industry that if these markets can't be responed soon sales organizations there may deteriorate badly.

#### HOME SALES DIP

Domestic sales took a sharp dip particularly in the export sector of the textile industry. Sales of laundry detergents still haven't reached prewar levels. Prices of oils and fats climbed steeply in the first few months of last year to levels five plus times higher than in 1939. Perfume sales lagged badly compared to 1947.

The chemical industry as a whole still is working at near capacity levels although employment began to fall over slightly this spring. The industry accounted for a slightly larger percentage of total Swiss exports last year —17.85 percent versus 17.70 percent the year before. It held its place as the third largest export industry in the country after watches and machines.

The United States not only was Switzerland's biggest supplier of chemicals last year, it was its second most (Continued)





#### FIRE PROTECTION Tailored FOR INDUSTRY'S NEEDS

Not unlike the clothing industry, effective fire protection must be tailored to fit the need . . . tailored to each individual requirement-occupancy-hazard and risk. Recent advancements now make it technically and economically possible to handle problems of extreme hazard to personnel and to production continuity. A typical problem was the storage of propane at the illustrated refining operation. With the problem studied, the hazard analyzed and the measurements exactingly approved, specialized Automatic FIRE FOG was installed and is today, ready, willing and able to combat fire at the first indication

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Western shell-and-tube exchangers, like those shown above, must perform steadily and efficiently to meet the high standards of high octane gasoline production at Sunray's Duncan plant, pictured above.

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See Western's catalog pages in the current issues of Chemical Engineering Catalog, Refinery Catalog, and Thomas Register.



Foreign News, cont. . . .

important customer. The volume of Swiss-American trade also increased considerably. Here are the figures:

#### Chemicals in Dollar Equivalents

| 1948 | U. S. Exports<br>to Switzerland<br>\$39,882,186<br>\$37,440,013 | U. S. Imports<br>From Switzerland<br>\$3.278,632<br>\$5.304,635 |
|------|---|---|
| 1947 | \$37,440,013  | \$0,574,950   |

The rapid comeback of Germany as a supplier and buyer of chemicals was another outstanding development of the Swiss chemical industry's foreign trading in 1948. Both imports and exports tripled over 1947 levels. The figures are:

#### Swiss-German Trade in Chemicals 1948

|  | Imports<br>From<br>Germany              | Exports<br>to<br>Germany                |
|--|---|---|
| Pharmaceuticals<br>and perfumes                                | 8729,256                                | \$1,102,880                             |
| Industrial<br>chemicals<br>Dyes, pigments<br>Fats, oils, waxes | \$6.197,960<br>\$2,422,399<br>\$103,046 | \$1,248,928<br>\$1,069,750<br>\$120,329 |
| Total  | \$9,462,661                             | \$3,541,887                             |

#### Swiss-German Trade in Chemicals 1947

|  | Swiss<br>Imports<br>From<br>Germany  | Swiss<br>Exports<br>to<br>Germany  |
|--|--------------------------------------|------------------------------------|
| Pharmaceuticals<br>and perfumes                                | 8329,990                             | \$500,948                          |
| Industrial<br>chemicals<br>Dyes, pigments<br>Fats, oils, waxes | \$1,960,208<br>\$849,918<br>\$26,383 | \$170,892<br>\$394,167<br>\$33,229 |
| Total  | \$3,166,529                          | \$1,099,256                        |

The following statistics for over-all Swiss trade in chemicals show a less marked improvement. Here they are:

#### Swiss Foreign Trade in Chemicals 1948

|  | Exports                                     | Imports                                     |
|--|---|---|
| Pharmaceuticals<br>and perfumes                                | \$12,579,352                                | 813,237,024                                 |
| Industrial<br>chemicals<br>Dyes, pigments<br>Fats, oils, waxes | \$30,441,743<br>\$67,334,068<br>\$2,616,911 | \$59,759,131<br>\$9,075,190<br>\$25,034,221 |
| Water!   | #158 679 674                                | 8107 105 560                                |

#### Swiss Foreign Trade in Chemicals 1947

|  | Exports                                     | Imports                                     |
|--|---|---|
| Pharmaceuticals<br>and perfumes                                | \$57,479,634                                | \$14,130,089                                |
| Industrial<br>chemicals<br>Dyes, pigments<br>Pats, oils, waxes | \$24,107,372<br>\$15,292,438<br>\$3,738,387 | \$59,944,920<br>\$7,431,743<br>\$22,660,887 |
| Total  | 1144,717,831                                | \$104,167,249                               |

The rapid recovery of German trade in chemicals may well herald a retreat of the U.S. industry from its present position of preeminence in Swiss trade. Before the war Switzerland exported 15.7 percent of its chemicals to Germany and relied on Germany for 23.2 percent of its chemical imports. Corresponding percentages for the U.S. were 6.9 percent and 7.8 percent prewar versus 5.25 percent and 37 percent today.

Germany has three advantages over the U.S. in trading with Switzerland. First, its geographical proximity. Second, German chemical firms normally maintain representatives in Switzerland whereas U.S. practice is to try to sell the Swiss market from the United States. Three, German manufacturers, according to the Swiss, make more of an effort to adapt their chemical products to the individual needs of their customers and to comply with the pharmaceutical regulations in force in various countries whereas as a rule U.S. products only conform to USP or the NF.

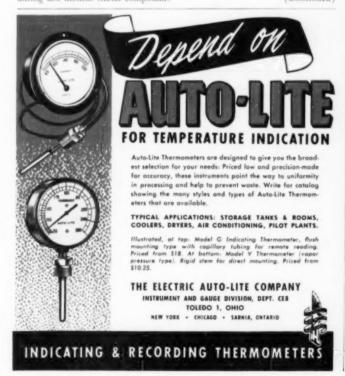
#### Larger Supplies and Greater Competition Weaken Solvent Prices in Great Britain

London—The hoped-for swift recovery of the British chemical market
after the holiday period has been prevented or at least delayed by uncertainty about the currency and general
economic situation. Assured of
prompt delivery of most chemicals,
consumers generally prefer to await
further developments before committing themselves far ahead. In these
circumstances home business is more
or less of a routine nature. Sales are
mainly confined to lots for early delivery, and inquiries from other than
regular users are disappointing.

There is much talk of the need for higher productivity and greater effort by managements and workers, but as far as the chemical trades are concerned, the need for drastic measures is apparently not believed to be urgent. Few price changes occurred during last month. Metal compounds

rose in line with the advance of the Ministry of Supply prices for virgin metals, and borax, white arsenic and a number of solvents have been reduced in price. Generally chemical prices remain unchanged.

The price cut for solvents is of some interest insofar as it coincides with the appearance in the market of larger supplies of solvents from the Shell petroleum chemicals plant at Stanlow which is now in full operation. Shell Chemicals Ltd. has lowered its prices for methyl ethyl and isobutyl ketones, for secondary butyl alcohol and for isopropyl ether from September 1. Other petroleum chemicals makers are known to expand their output. Irano Products Ltd., distributors for the Anglo-Iranian Oil Co. Ltd., is marketing two new sodium alkyl sulphate products. Petro-(Continued)



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Fig. 645

Are your scrubbing nozzles as efficient as you think they could be? Do they resist the corrosion or wear conditions satisfactorily—Produce the breakup and distribution you would like?

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Outline your spray problem for us—if your liquid can be sprayed with direct pressure at all—Monarch can furnish the nozzles.

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FOREIGN NEWS, conf. . .

chemicals Ltd. has announced that its 1949-50 production will include thiophene-free benzene and toluene, xwlene, close-cut aromatic solvents, methyl naphthalenes, ethylene, ethylene and propylene oxide and glycol, isopropyl alcohol and aromatic bitumens. Growing supplies of these and other petroleam-derived chemicals cannot remain without effect on the price level of the products.

The big works of Imperial Chemical Industries Ltd. at Wilton began operations on September 14. A statement to this effect was made in August when it was also disclosed that the plant would soon provide employment for 3,000 people and was expected to give work to 8,000 by 1951 and 11,000 by 1955. Designed for the use of both coal and petroleum as raw materials, the Wilton works were, according to an earlier announcement, to begin the production of phenol formaldehyde molding powder and "Perspex" acrylic sheet by the summer of 1949. Later many more organic chemicals will be produced at Wilton, including a good many which will also be provided by specialized petroleum chemicals plants now in course of erection or extension.

Prospective producers are of course trying to test the market before actually starting production, but little seems to be known as yet of the total supply of various products from all the new plants and even less of the likely outlets open at various price levels. Considerable competition, however, is anticipated and has already been noticed in some of the new products introduced into the British market by local producers, especially synthetic detergents.

Growing attention is being paid by chemical manufacturers to the export market in view of the apparent safuration of the home market and the difficulties being experienced of late in many foreign countries owing to import restrictions, currency shortages and intensified competition. While Lord McGowan, chairman of Intperial Chemical Industries Ltd., told workers of his company that "the slight recession in business apparent today" would not go far and buy resistance was already slackening. Lord Trent, chairman of Boots Pure Drug Co. Ltd., told his shareholders that "the heetic rise of Britain's export trade in the past three years has been unreal and unhealthy." The export drive would have to be conducted on more expert lines now that the transient phase of world demand for any goods at any price had come to an end.

Lord McGowan, on the other

hand, believes that the trade position will be stabilized "in the not too distant future." South America would become an even greater market for British manufactures, and even in the United States there were still outlets for ICI commodities. At home the textile industry was clearing its stocks and could be expected to begin buying ICI dyestuffs again in the near future.

Additional finance of \$25,000,000 is being sought by Fisons Ldt., the company accounting for about half the trade in chemical fertilizers in Britain, in connection with the plant extension program initiated in response to the government's call for increased production of phosphatic fertilizers. Over \$20,000,000 are needed for the ensuing development program. It includes a new triple superphosphate factory at Immingham which it is hoped to put into opera-tion within the next twelve months, and another \$7,000,000 are required for financing stocks at increased value and additional turnover. Fison's fertilizer sales in the year ended June 1949 were about 100,000 long tons up on the previous year and substantial further output gains are expected as more of the extensions and new plant under construction are reaching the productive stage. Although British agriculture is entering a new and more critical phase with the return of more normal conditions in overseas food producing areas and the Ministry of Agriculture has announced its intention of gradually withdrawing the fertilizer subsidy in the next two years, Fison's like other British fertilizer manufacturers anticipate that all factories will be able to work to maximum production for some years to

The paint industry has suffered an appreciable contraction of export business in many important products, including earth colors, lithopone, metallie pigments gen rulb, lead and zinc oxide in paste form and ships' bottom compositions, but this bas on the whole been offset by increased shipments of unspecified dry pigments and bituminous paints, largely to soft-currency markets. The home market, though adversely affected by a downward revision of postwar housebuilding targets, has been kept up well so far by larger demands for delaved maintenance painting. Never-theless, considerable difficulties are being anticipated for the near future. and leading producers endeavor to improve their connetitive position by increased mechanization. Thus Pinchin, Johnson & Associates, Ltd. the biggest firm of paint makers in Brit-

(Continued)

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In addition, ATLAS equipment withstands high working temperatures—withstands fats, oils, greases, water and live steam.

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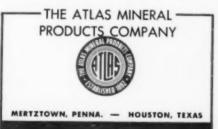
Atlas Engineers are ready to study your flooring problem, to makerecommendations and submit plans and estimates—all without obligation.



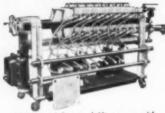
Battery of 87 concrete tanks, each 7' x 4' x 9' deep, lined with Atlastiseal and brick joined with KOREZ. These are electrolytic tanks handling 20% H.SO, and 20% CuSO, at 180' F.



Floor of Atlas acid-proof brick in a dye and pigment factory. Floors joined with Atlas ALKOR (the original acid- and alkali-proof cement), take temperatures up to 360°F.



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SHRIVER FILTER PRESSES Not only in normal recovery of solids or in clarification of liquids where many thousands of Shriver Filter Presses have long been the dependable servants, but how about special conditions of

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THE THERMAL SYNDICATE, LTD.

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FOREIGN NEWS, cont. . .

ain, intends to erect a new building in the London area, "with the most modern layout, designed for large volumes of highest-quality products, and with maximum flexibility of operation." A separate, small-batch factory has been completed by the company in London for works-scale experimentation and to deal with relatively small order batches to suit individualistic needs so as to relieve the bigger producing units of uneconomic loads. Further installations including bulk resin and medium making plant are to be provided, and an extensive program of rehabilitation and expansion is being carried out.

Substantial investments are also being made by smaller paint manufacturers with special regard to opportumities opened by the British petroleum chemicals industry, the cultivation of vegetable substitutes of linseed oil in Britain's African colonies and changes in surface coating techniques resulting from these and other factors.

Radioactive isotopes made at the Atomic Energy Research Establishment at Harwell have been sent to German universities for use in biological and medical research for a few months now.

Chemicals, dvestuffs and paints worth \$5,000,000 are to be sent to Brazil by British manufacturers under the 1949 Anglo-Brazilian Trade Agreement which has now been con-

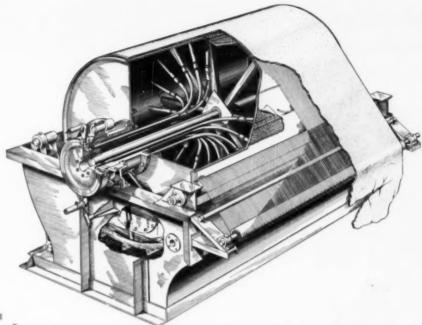
British chemical exports in July suffered a further decline to \$25,700,-000, compared with \$27,800,000 in June and \$32,360,000 in May, largely owing to a decline in shipments to India where importers are believed to be holding substantial stocks of many chemical products.

#### Indian Glass Industry Wants Cut in Imports

Bombay — Seeking protection against lower-priced foreign products, the Indian glass industry has stated to the Indian Tariff Board that its rated capacity is between 15 and 20 million square feet of sheet a year compared with national requirements for at least 32 million annually for the next three years.

Industry spokesmen told the board that so much foreign glass has been imported during the past year that the three largest sheet producers have temporarily suspended production. Because of this they are asking quantitative restrictions on imports as well as price protection.

—End



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There's no scraper, so cloths last longer, and don't plug up. No compressed air blow-back, so there's no filtrate returned to the cake, no wire winding to impede cloth changes. Handles cakes as thin as 1/16'', including semi-colloids and slimes, with no limit to thickness. Other FEinc features solve washing and drying problems, too.

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## The Corresion Forum

EDMOND C. FETTER, Assistant Editor

#### Hydrofluoric Acid versus Construction Materials

Part III of a three-part symposium in which a representative group of construction materials are evaluated for services involving HF.

#### Lead

KEMPTON H. ROLL, Lead Industries Association, New York, N. Y.

Hydrofluoric acid is one of the principal mineral acids to which lead is corrosion resistant. Lead of å in, or greater thickness usually gives years of service in equipment handling this chemical, particularly if the acid is at room temperature.

The limiting concentration lies in the range of 60 to 65 percent, depending on the acid temperature. Lead has been used successfully with unaerated 60 percent acid up to the boiling point (184 deg. F.). Nevertheless the use of lead with hydrofluoric acid at temperatures above room temperature is generally to be recommended with

Considerable lead is used for storage, conveying and pumping hydrofluoric acid solution. At one time it was also used extensively for shipping the acid.

Some actual plant corrosion tests were conducted in dilution and storage vessels for 60 to 40 percent hydrofluorie acid. At average atmospherie temperatures, the test specimens were immersed in the acid solution for a period of 33 days. The lead corroded at the rate of 3 mils per year. In another test, commercial 60 to 65 percent hydrofluoric acid containing 15 to 25 percent fluosilicic acid, 0.3-1.25 percent sulphuric acid and 0.01-0.03 percent iron was held in storage. The test specimen was immersed in the solution which ranged from 60 to 80 deg. F. in temperature. After 28 days exposure, the corrosion rate for lead was shown to be 16 mils per year.

A reprint of all three parts of this symposium on hydrofluoric acid is available at 35c, per copy. Address Editorial Dept., Chemical Engineering, 330 W. 42nd St., New York 18, N. Y.

Many ore roasting plants convert their roaster gases to sulphuric acid, in this manner protecting the community against hazardous air contaminants as well as recovering a valuable product. Due to the presence of fluoride minerals in most zinc ores, the roaster gases often contain fluoring which must be removed prior to sulphur dioxide conversion. This is almost invariably accomplished by forming hydrofluoric acid and collecting it in lead-lined vessels. In one installation fluorine is encountered in a corrosive coolant liquor to the extent of 1 g./liter. No effect on the lead linings in the coolant handling equipment has been apparent for the past several years of operation.

In the manufacture of anhydrous hydrofluoric acid (AHF), lead is satisfactorily used as a construction material for circulating pumps.

It is important in discussing corrosion that a uniform system of designation be used, such as mils or inches penetration per month or year, or milligrams per square decimeter per day. But either of these systems can be somewhat misleading insofar as the common tendency is to judge best performance on the basis of the lowest corrosion rate. This is especially true in the case of lead in chemical equipment which for mechanical reasons is used in thicknesses generally of & in. or greater. Such thicknesses are of a distinct advantage from a corrosion viewpoint. Other corrosion resistant materials are normally used in much lighter thicknesses. Thus for equal uniform corrosion rates, lead would far

outlast such other materials because of tais difference in thickness.

Designating corrosion rate according to weight loss as milligrams per square decimeter per day instead of volume loss as inches penetration per year is also misleading in the case of lead since lead has the highest density of any commonly used corrosion resistant material. This means that what might appear to be an excessive corrosion rate expressed in weight loss of lead could actually be a very nominal rate of corrosion in terms of volume loss.

When comparisons are being made between various corrosion resistant materials it follows that an understanding and appreciation of the above will lend much to the proper interpretation of corrosion rate data.

#### Silicones

J. A. McHard and A. F. Kolb, Dow Corning Corp., Midland, Mich.

Dry hydrofluoric acid rapidly attacks silicone fluids and polymers to form volatile products. The aqueous acid reacts more slowly and the extent of reaction depends upon the type of silicone.

Tests carried out by heating samples of various silicone products at 80 deg. C. for nine days in contact with aqueous, 48 percent hydrofluoric acid are summyrized in the following table.

The progress of the deterioration appears to be toward low polymers and consequently more volatile products as shown by weight loss and viscosity data. Literature sources 128 also bear out the conclusions reached here. Hydrofluoric acid apparently attacks the (Continued)

#### Effect of Heating Silicones in 48 Percent HF (Nine Days at 80 Deg. C.)

|                              | Weight of         | Sperimen         | Viscosity in Catks. |                  |  |
|------------------------------|-------------------|------------------|---------------------|------------------|--|
| Type of Bilicone             | Pefore<br>Heating | After<br>Heating | Pefore<br>Heating   | After<br>Heating | Remarks  |
| DC 200                       | 3.5135            | 0.5310           | 206                 | 16               | Fluid remained clear with no dis-<br>discoloration.          |
| DC 710                       | 3,7676            | 0.6524           | 476                 | 294              | Fluid remained clear with no dis-<br>coloration.             |
| Greace<br>DC Valve Seal A    | 3.8171            | 0.6325           |                     | 15               | Sample last its consistency and<br>became fluid.             |
| Elastomers<br>Silastic* 125  | 5.7542            |                  |                     |                  | Specimen powdered and dis-<br>integrated.                    |
| Silastic 150                 | 7,8703            |                  |                     |                  | Specimen powdered and dis-<br>integrated.                    |
| Silastic 181<br>Silastic 250 | 4.7328<br>5.5921  | 0.3029           |                     | 111              | Specimen badly deteriorated,<br>Specimen badly deteriorated. |

<sup>\*</sup> Trade-mark Registered, Dow Corning Corp.,



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Table I-Laboratory Corrosion Tests, Monel in Hydrofluoric Acid

| Acid<br>Cone.,<br>S. HF<br>By Wt. | Temp.,<br>Deg. F. | Dura-<br>tion<br>of Test,<br>Days | Other Test Conditions  | Corre<br>Wrought<br>Monei | uion Rate,<br>Cast<br>Monel | Mile per | Year<br>Mon |
|-----------------------------------|-------------------|-----------------------------------|--|---------------------------|-----------------------------|----------|-------------|
| 10                                | 70                |                                   | Immersed in open container                                   |                           |                             |          |             |
| 10                                | 136               | 0.6                               | Immersed in open container                                   | 9                         |                             |          |             |
| 25                                | 86                | 6                                 | Air-free, immerned in closed con-                            |                           |                             |          |             |
|                                   |                   |                                   | tainer, velocity 42-73 ft. min.                              | 0.2                       | 0.6                         | 0.4      | 01.2        |
| 25                                | 86                | 1                                 | Air-saturated, immersed in closed                            |                           |                             |          |             |
|                                   |                   |                                   | container, velocity 42-73 ft. min.                           | 37                        | 19                          | 19       | 50          |
| 25                                | 176               | 6                                 | Air-free, immersed in closed con-                            |                           |                             |          |             |
|                                   |                   |                                   | tainer, velocity 42-73 ft. min.                              | 2.4                       | 1.3                         | 0.4      | 10.         |
| 25                                | 176               | 1                                 | Air-enturated, immerced in closed                            |                           |                             |          |             |
|                                   |                   |                                   | container, velocity 42-73 ft./min.                           | 11                        | 1269                        | 22       | 21          |
| 35                                | 248               | 65                                | Air-free, immersed in closed con-                            |                           |                             |          |             |
|                                   |                   |                                   | tainer   | 1.1                       |                             |          |             |
| 675                               | 68                |                                   | Immersed in open container                                   | 4                         |                             |          |             |
| 48                                | 240               | 8                                 | Immersed in closed container                                 | 0.9                       |                             |          |             |
| 80                                | 796               | 6                                 | Air-free, immersed in closed con-                            |                           |                             |          |             |
|                                   | 200               |                                   | tainer, velocity 42-73 ft. min.                              | 0.1                       | 0.5                         | 0.2      | 0.8         |
| 50                                | 360 s             | 1.                                | Air saturated, immersed in closed                            |                           | -                           | -        | -           |
| ***                               |                   | -                                 | container, velocity 42-73 ft. min.                           | 8                         | 6                           | 7        | 3           |
| 30                                | 176               | 6                                 | Air-free, immersed in closed con-                            |                           | 20.00                       | 0.11     | 700 114     |
| 50                                | 176               |                                   | tainer, velocity 42-73 ft. min.                              | 0.6                       | 2.2                         | 0.9      | 2.0         |
| 287                               | 110               |                                   | Air-saturated, immersed in closed                            | Tion                      | 0.7                         | **       | 400         |
| 60                                | Room              | 2                                 | container, velocity 42-73 ft. min.                           | 39                        | 37                          | 4.5      | 461         |
| 70                                | 70                | 5                                 | Immersed in open container                                   |                           |                             |          |             |
| 70                                | 122               | 4                                 | Immersed in closed container<br>Immersed in closed container | 0.1                       |                             |          |             |
| 70                                | 240               | 36                                | Immersed in closed container                                 | 17                        |                             |          |             |
| 93                                | 70                | 8                                 | Immersed in closed container                                 | 3                         |                             |          |             |
| 98                                | 240               | 20                                | Immersed in closed container                                 | 2                         |                             |          |             |
| 100                               | 100               |                                   | Immersed in closed container                                 | -                         |                             |          |             |
| 1151                              | 2182              |                                   | velocity 1,700 rpm.  | 0.9                       |                             |          |             |
| 1189                              | 3000              | - 14                              |  |                           |                             |          |             |
| 1187                              | 201.063           | 8                                 | Immersed in closed container                                 | 0.9                       |                             |          |             |

Corrosion Forum, cont . . .

silicone molecule at the Si-O-Si linkage rather than at the C-Si bonds. No hydrocarbons have been detected in the byproducts of these reactions.<sup>8,4</sup>

From the data here and in the litcrature, one would conclude that silicones of the type (R<sub>s</sub>SiO), react with HF to form eventually R<sub>s</sub>SiF<sub>2</sub>.\*

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#### Nickel, Nickel Alloys

W. Z. FRIEND, International Nickel Co., New York, N. Y.

HYDROFLUORIC ACID - Experience with Monel in a variety of applications involving hydrofluoric acid has shown it to be usefully resistant to all concentrations of the acid including anhydrous acid over a considerable range of temperatures. It is, in general, the most resistant material with the exception of platinum and silver. In hydrofluoric acid-water solutions. except in those which are highly aerated, Monel has shown satisfactory resistance up to 250 deg. F., the highest temperature for which test data are available.1 The results of laboratory corrosion tests in hydrofluoric acid solutions are shown in Table I. The results of plant corrosion tests in hydrofluoric acid pickling solutions are shown in Table II.

The indications are that the corrosion resistance of Monel is not adversely affected by the presence of small amounts of reducing sulphur compounds or of sulphuric acid in hydrofluoric acid solutions. However, its corrosion rate may be appreciably increased by a high degree of aeration of the solution. Table I shows the effect of air saturation of 25 and 50 percent acid solutions on the corrosion rate of Monel at 86 and 176 deg. F.

Tests with highly stressed specimens in commercially pure acid solutions, and general plant experience, have shown that Monel is not subject to stress-corrosion cracking in hydrofluoric acid which does not contain appreciable amounts of fluosilicic acid.

Monel is comparatively insensitive to effects of velocities which considerably increase the corrosion rates of such materials as copper and bronzes in strong hydrofluoric acid. This is shown by the satisfactory performance of Monel bubble caps in HF distillation columns. Other examples of suitable applications of Monel for such equipment as acid recovery towers and heaters, valves, bolts, pumps, and pipe lines in the most corrosive conditions encountered in alkylation-plant operation, have been cited. a.a The results of plant corrosion tests in hydrofluoric acid alkylation plants are shown in Table III on the next page

(Continued)

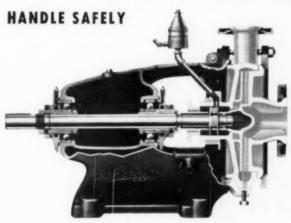
Table II-Plant Corrosion Tests in HF Pickling Solutions

|                            | Corrosion Rates, Mile po<br>6% HF<br>Temperature.: 170 Deg. F. |                          |                                  |  |  |  |
|----------------------------|--|--------------------------|----------------------------------|--|--|--|
| Monel<br>Nickel<br>Inconel | 4 Day Test<br>0.8<br>350<br>363                                | 28 Day Test<br>0.2<br>68 | 30 Day Test<br>0.1<br>0.1<br>0.1 |  |  |  |
| Ni-Resist<br>Cast Iron     | 980  | 540                      | 220                              |  |  |  |

Test specimens immersed in solutions in pickling tanks used for pickling cast iron. <sup>2</sup> Specimens completely corroded away; original thickness 3/16 in.

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#### Table III-Corrosion Tests in HF Alkylation Plants

Table III—Corrosion Tests in HF Alkylatio

Test 1—Inter side of preheater channel,
Plant A. Liquid composition; 79-92 percent HP, 0.8-2.5 percent water, remainder
isobutane and acid-soluble oil. Temperature; av. 120 deg. F., max. 135 deg. F.
Duration of test, 111 days.

Test 2—Outlet side of preheater channel,
Plant A. Composition same as Test 1. Temperature; av. 235 deg. F., max. 260 deg.
F. Duration of test, 111 days.

P. Duration of test, 111 days.

0.9-5 percent HF and 5-10 percent biolutane.

Acid phase: 90-95 percent HF,
0.5-2.5 percent HF,
0.5-2.5 percent water, 1.0-5.0 percent of
test, 70 days.

Test 4—Top of regeneration column.
Frant B. Composition: equal parts of 95
percent me, 200 percent me, 200 percent me,
Figure 1.0 percen

(Plant B) in acid tar containing, in 1 H ratio, water and 1-10 percent HF. Tem-perature: av. 250 deg. F. Duration of test, 49 days. Test 6—Bottom of regeneration column,

Test 6—Bottom of regeneration column, Plant C. Feed to column contains 85.2 percent HF, 1.5 percent water and oils. Test made beneath grid plate of column. Feed, 194 bbl. per day. Temperature; av. 220 deg. F., max 250 deg. F. Duration of test, 45 days. Test 7.—Bottom of dehydrator column

Test 7—Bottom of dehydrator column beneath bottom piate, Plant C. Feed con-tains 89.3 percent HF and 1.4 percent water. Feed rate, 1.5 bbl. per day. Tem-perature: av. 225 deg. F. max 250 deg. F. Duration of test 45 days. Test 8—Top of HF stripper column above top tray, Plant A. Composition of vapor: 19 percent HF and 99 percent light hydrocarbons. Temperature: av. 110 deg. F., max. 150 deg. F. Duration of test 117 days.

#### Corrosion Rate, Mils per Yest-

|                  |        | 1.00  |        |         | 703-363       |
|------------------|--------|-------|--------|---------|---------------|
|                  | Monel  | Monel | Nickel | Incomel | Copper-Nickel |
| Test I           | 0.3    |       | 1.1    | 0.8     | 1.1           |
| Test 2<br>Test 3 | 0.5    |       | 3.5    | 19      | 0.7           |
| Test 4           | 0.5    | 1.4   | 14     | 25      | 5.3           |
| Test 5           | 7.5    | 10    | 11     | 23      | 21            |
| Test 7           | <br>22 | 39    | 68     | 20      |               |
| Test 8           | 0.7    |       | 0.7    | 0.5     | 1.3           |

<sup>\*</sup> Completely corroded away; original the kness 0.032 in. (32 mils),

Corresion Forum, cont . . .

The corrosion rates for Monel can be applied equally well to "K" Monel. a wrought age-hardening nickel-copper alloy, and to the cast alloys, Monel (containing approximately 3 percent silicon) and "S" Monel (containing approximately 4 percent sili-con). "K" Monel is used for such con). parts as pump shafts, valve stems, and bolts, which are subject to high stresses

"S" Monel, having high hardness and galling resistance, is used for such parts as gate and plug valves, pump parts, and sometimes for non-lubricated bearings, where scizing must be avoided or where "freezing" of steel parts might occur.

Limited experience with nickel indicates that in dilute hydrofluoric acid solutions its extosion resistance may be limited to temperatures below about 170 to 180 deg. F. In a commercial 60-65 percent acid, it was corroded severely at atmospheric temperature.

#### INCONEL AND NI-RESIST

Inconel is resistant to aqueous hydrofluoric acid solutions at atmospheric temperature and sometimes to temperatures as high as 160 to 170 deg. F. The presence of small amounts of ferric salts in commercial solutions is favorable to the performance of Inconel.

The alloy cust iron, Ni-Resist, containing 13.3-17.5 percent nickel, 5.5-7.5 percent cooper and 1.75-2.5 percent chromium, is resistant to dilute aqueous hydrofluoric acid solutions at atmospheric temperature but not at elevated temperatures. It was appreciably corroded by commercial 60-65 percent acid at room temperature. Ni-Resist was reported to suffer graphitization in anhydrous acid.

HYDROGEN FLUORIDE-Laboratory corrosion test results reported by Myers and De Long' and given in Table IV have shown Monel, nickel and Inconel to be among the materials most resistant to anhydrous hydrogen fluoride at temperatures up to 1,100 deg. F. Tests in mixtures of hydrogen fluoride and steam reported in Table V showed suitable resistance for nickel and Monel. If sulphus compounds are present, nickel and Monel may be subject to intergranular sulphur attack at temperatures above about 570 deg. (Continued)

#### Table IV-Corrosion of Various Metals by Anhydrous HF at Elevated Temperatures

|                | At 500: | Rate, Mils<br>At 550<br>Deg. C | At 600     |
|----------------|---------|--------------------------------|------------|
| Nickel         | 3       |                                | 3          |
| Monel          | 1       | - 8                            | 07         |
| Copper         | 5.      |                                |            |
| Inconel        | 5.5     |                                | 4.5        |
| Aluminum (28)  |         |                                | 3.94       |
| Magnesium (Dos | V       |                                | 300        |
| Metal Gr.      | 1.2     |                                |            |
| 1020 Steel     | . 51    | 8%                             | 25         |
| Tyrue 3014     |         |                                | 4.4        |
| Type 347       | 600     | 1.500                          | Sterio     |
| Type 309-Cb    | 19      | 1.40                           | 550        |
| Type 310       | -10     | 330                            | 1.000      |
| Thomas 4200    |         |                                | 2 . 100.00 |

#### Table V-Corrosion of Nickel and Monel in Hydrogen Fluoride-Steam

|                | per ! | Corrosion Rate, Mils<br>per Month |  |
|----------------|-------|-----------------------------------|--|
|                | Monel | Nickel                            |  |
| At 550 deg. C. |       | 2.6                               |  |
| At 600 deg. C. |       | ei.                               |  |
| At 650 deg. C. | 3     | 9                                 |  |
| At 700 deg. C. | . 13  | 12                                |  |
| At 750 deg C   | 17    | 10                                |  |



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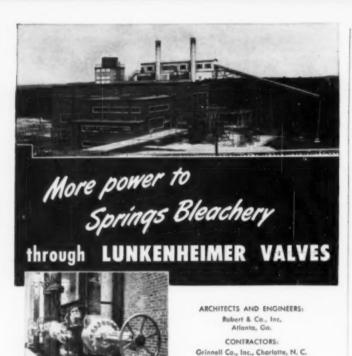
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CORROSION FORUM, cont . . .

F. In such applications at higher temperatures Inconel would be preferred

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#### Durimet-20

WALTER A. LUCE, Duriron Co., Dayton, Ohio

Durimet-20 provides good resistance to many concentrations of hydrofluoric acid and is utilized in industry where this severe corrosion is encountered. It is especially valuable if the operating conditions are sufficiently oxidizing to render unsuitable many of the other hydrofluoric acid resisting alloys, which

usually contain high copper.

Durimet-20 is a highly alloyed austenitic stainless steel with a nominal chemical composition in the cast form of 29 percent Ni, 20 Cr, 2.5 Mo, 3.5 Cu, 1.0 Si, 0.07 C max and balance Fe. It is available in the form of castings and equipment made from castings such as pumps, valves, fans, ejectors, jets and mixing nozzles. Rough castings are supplied various other manufacturers who produce diversified equipment in this composition.

Laboratory testing of Durimet-20 in several concentrations of dilute hydrofluoric acid showed the following re-

|  | Mils per Year |         |      |
|--|---------------|---------|------|
| HF Conc                                | 500           | 15%     | 25 . |
| Durimet-20<br>Room temp.<br>50 deg. C. | 3<br>10       | 5<br>14 | 17   |
| 80 deg. C.                             | 11            | 21      | 28   |

These data indicate that excellent service can be expected at the lower concentrations even above normal temperatures. Substantiating results were obtained from a group of plant tests which showed Durimet-20 to be the equivalent of other known hydrofluoric acid resisting alloys at concentrations up to 20 percent at moderate temperatures, even in non-acrated solutions. Another group of tests conducted under a slight degree of acration indicated low corrosion rates on Durimet-20 at all concentrations of this acid at normal temperatures.

Plant experience has shown Durimet-20 to be an acceptable alloy for concentrations of the pure acid above 60 percent. For instance, one chemi-

(Continued)

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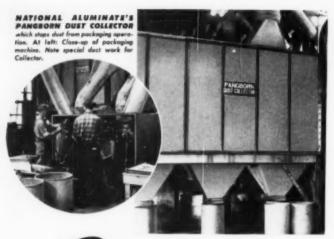
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\$14,859... that's how much Pangborn Dust Control saves The National Aluminate Corp. of Chicago, Ill. each year! Chemicals, used to make NALCO products (which prevent scale formation in boilers, etc.) are recovered by five Pangborn Collectors to the tune of 3900 lbs. a day! At current prices for raw material that spells \$58.50 a day, or a \$14,859 profit each year. As L. A. Scheidler, plant superintendent, says: "We couldn't operate without Pangborn Dust Control... the collectors have paid for themselves!"

#### HOW ABOUT YOUR PLANT?

Unknown to you, dust may be costing you money. Find out . . . let us make a "dust pocket" survey of your plant at no obligation! Pangborn engineers show you how Pangborn Dust Control can save you money. For full information write for Bulletin 909A to: PANGBORN CORPORATION, 283 Pangborn Blvd., Hagerstown, Md.

Look to Pangborn for the latest developments in Dust Control and Blast Cleaning Equipment.



P THE DUST HOG from stealing profits with

angborn

CORROSION FORUM, CONT . . .

cal plant used Durimet equipment for handling 60 percent HF at ambient temperatures and the 80 percent acid at approximately 35 deg. C. Durimet-20 has also been utilized to a limited extent on anhydrous hydrofluoric acid with excellent results. The fact that low carbon steel is a satisfactory material for AHF generally limits the use of higher allow materials of construction. Durimet-20 "Y" valves after two years' service on cold HF of undisclosed concentration in one chemical plant showed no visible signs of corrosion.

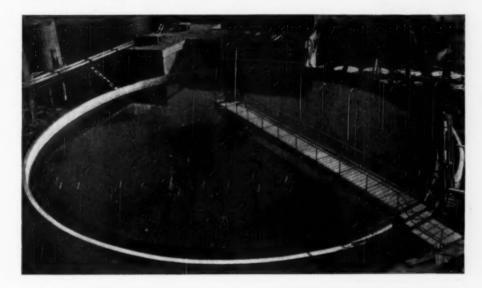
Acrated hydrofluoric acid or solutions containing oxidizing materials in which HF exists in a substantial concentration are those in which Durimet-20 provides exceptionally good service. The common stainless steel pickling solution, which may contain from 3-5 percent hydrofluoric acid and up to 20 percent nitric acid and operating at temperatures up to 170 deg. F. is an excellent example of the latter type and is an exceptionally severe service for heating equipment; i.e., steam jets. Although by no means immune to attack, plant tests on Durimet-20 samples and actual equipment proved it to be the most economical material of construction available. Equipment such as valves, jets, and tank outlets are being employed on such installations. Durimet-20 pumps are also utilized on these installations and often handle other pickle solutions and waste acid in addition to the nitric-hydrofluoric mixture. Durimet-20 valves are also being used by many refineries in alkylation processes embodying the use of hydrofluoric acid.

Durimet-20 has also been under test on many severe services encountered in the production of hydrofluoric acid where fluorspar is treated with concentrated sulphuric acid. It is known that slightly oxidizing conditions tend to exist in this service. The use of this alloy for certain equipment is indicated by these plant and service tests. One of these tests consisted of installation of actual equipment.

Wrought Dutimet-20 is produced by the Carpenter Steel Co. and is supplied under the name Carpenter Stainless No. 20. The present forms in which the wrought alloy is available include wire, rods, bars, sheet, plate, strip, and welded pipe and tubing. Duriron or Carpenter Steel should be consulted regarding the sizes of the various forms available. Durimet-20 welding electrodes and certain fastenings can also be obtained.

Plant tests conducted on Carpenter 20 and several other alloys recom-(Continued) EFFECTIVE

#### LOW COST INDUSTRIAL WATER TREATMENT



#### with the DORRCO HYDRO-TREATOR

The Dorroo Hydro-Treator is a high rate, upflow water treatment unit that gives you flocculation, sludge thickening and clarification in a single, compact structure. As feed is distributed, heavy, gritty solids quickly settle to the floor of the Flocculator compartment and are raked inward to the central discharge cone. Light, flocculated solids drift into the sludge well, and are thickened as they settle to the discharge cone. Clarified water is overflowed at the surface.

Treatment is effective because raw water is distributed evenly and without disturbance throughout the entire flocculation zone... because the rotating distributor arms maintain uniform flocculation conditions . . . because zoned sludge thickening promotes maximum density of settled solids. Rotating rakes provide continuous, *positive* sludge removal . . . an essential for high rate treatment.

First cost is held to a minimum by simplicity of Hydro-Treator tank and mechanism design, Treatment cost is low because Hydro-Treator mechanism promotes fast chemical reactions without interference among the three treatment zones.

Available in standard sizes ranging from 10 to 100 feet in diameter, the Dorrco Hydro-Treator will handle softening, turbidity, or color removal effectively . . . and with economy. A Dorr engineer will gladly supply more detailed information.

Pictured above is a typical Hydro-Treator installation removing algae, turbidity and color, and producing clear process water for a South American paper mill. A duplicate until is located alongside the one shown. Total maximum capacity...25 M.G.P. Turbidity reduction...97% from river water supply.

RESEARCH DGINEEUG RUIPER



THE DORR COMPANY, ENGINEERS 570 LEXINGTON AVE., NEW YORK 22, N. Y.

ATLANTA • TORONTO • CHICAGO DENVER • LOS ANGELES RESEARCH AND TESTING LABORATORIES WESTPORT, CONN.

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TREE & DORR DIVISION, NEW YORK 22, N.
ASSOCIATES AND REPRESENTATIVES

Dorr Technical Services and Equipment Are All Available Through Associated Companies and Res resentatives in the Principal Cities of the Wark Names and Addresses on Request.



#### DRYERS — DRYERS — DRYERS

STANDARD Rotary dryers are used throughout the world. STANDARD dryers are competently engineered and sturdily built in a wide variety of types and sizes for drying various products. such as fish meal, garbage, tankage,

humus, fertilizer, sewage, aludge, agricultural products and countless chemicals. Stock designs available in sizes of 2 feet to 10 feet diameters. Let our engineers help you with your prob-

We welcome your inquiries.

#### STANDARD STEEL CORPORATION

**Engineers**—Manufacturers



CORROSION FORUM, cont. . .

mended for use in the etching of glassware where two solutions must be separately handled, namely, (1) 47 percent hydrofluoric acid and 6 percent hydrofluosilicic acid at normal room temperature and (2) 15 percent nitric acid at normal room temperature, showed the following results:

orrosion Rate, Miln per Year

Durimet-20 is also being applied in numerous other solutions where hydrofluoric acid is encountered in small percentages. Typical examples include halogen tin plating solutions and crude phosphoric acid production by the wet

#### Rubber-Lined

E. L. LOCKMAN, United States Rubber Co., New York, N. Y.

Rubber linings can be supplied which will satisfactorily handle hydrofluoric acid under a variety of service conditions. The determination as to whether soft or hard natural rubber or one of the synthetics should be used depends upon the concentration of the acid, operating temperature and whether or not the condition is an abrasive one.

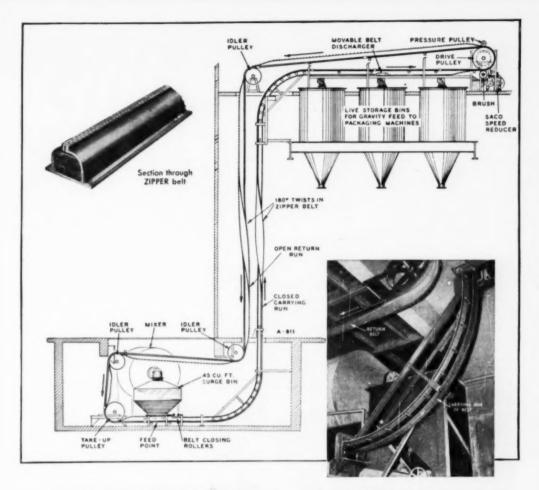
Soft butyl and neoprene linings are suitable for handling 60 per cent acid at temperatures up to 160 deg. F. Weaker concentrations of the acid may be handled at temperatures as

high as 220 deg. F. Hard natural rubber linings will satisfactorily handle 40 percent acid at room temperature or weaker concentrations may be handled at slightly higher temperatures. Soft natural rubber linings should not be used in contact with hydrofluoric acid containing more than 3 percent acid at room temperature.

As can be seen from the above, butyl and neoprene linings are usually specified for hydrofluoric acid service. All types of equipment such as storage equipment, pipe and fittings, re-action vessels and shipping containers have been lined with these two materials with very satisfactory results. Experience indicates that butyl linings are superior to neoprene linings at temperatures above 200 deg. F., but at lower temperatures neoprene linings have better physical properties, particularly for handling abrasive conditions such as caused by slurries.

Mixtures of hydrofluoric acid with other acids such as nitric can also be

(Continued)



#### "ZIPPER" A Rubber Pipeline For Soap

Several detergent products are handled from mixer to storage bins over packaging machines by ZIPPER belt conveyor-elevator shown above. Each product (Soilax, Electrasol, Tetrox, etc.) is a different color and all are of a hygroscopic nature. Previous handling equipment required lengthy shut-downs for scrubbing and cleaning when changing from one product to another. The ZIPPER belt is simply opened at discharge and thoroughly cleaned by a rotating brush... to time lost for changeover.

ZIPPER conveyor belt construction is shown in the cross section above. Guide rollers how the sidewall belts together and mesh the teeth at the feed point. Material is protected from contamination, spillage and agitation until desired discharged point is reached where belt is opened up, completely emptied and returned over rollers and pulleys to feed point.

Check with S-A engineers for a bulk handling system designed to do the best possible job at lowest cost per ton handled.



ECONOMICS LABORATORY, Inc.
LYNDHURST, NEW JERSEY

Mixed material is fed to the lower run of the ZIPPER belt and is elevated 40 feet to storage bins over packaging machines. A movable belt discharger places material in proper bin. A 2400 pound batch of material can be moved from mixer to storage in about four minutes. A rotating brush cleans the belt as it passes over the head pulley. Material is completely enclosed by the ZIPPER belt from feed to discharge. ... no contumination, no spillage. For further information on the ZIPPER Belt Conveyor-Elevator write us for a copy of bulletin 349.

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

CORROSION FORUM, CORt. . .

satisfactorily handled with neoprene or butyl linings provided the concentration of each acid does not exceed 35 percent at room temperature.

A removable type of liner made from a butyl compound suitable for use in 5, 25, and 55 gal, steel drums for the transportation of 60 percent hydrofluoric acid has recently been developed and should have wide application.

#### Protective Coatings

KENNETH TATOR, Kenneth Tator Associates, Coraopolis, Pa.

Hydrofluoric acid above concentrations of 60 percent may be satisfactorily held in passivated mild carbon steel. Hence the use of organic barriers above this concentration serves only to protect the acid from iron contamination. For such uses the thin sprayed and baked phenolics or furance are suitable.

Anhydrous hydrofluoric acid with its great affinity for water has a degrading effect on most organics by charring or other evidences of dehydration. This effect is most noticeable in those materials having available hydroxyl groups, such as wood, and most resisted by the hydrocarbons, such as polyethylene.

Teflon, as might be expected of this fully fluorinated polyethylene, is most resistant and in wide use for gaskets.

At concentrations below 60 percent hydrofluoric acid is highly corrosive. For example at a concentration of 48 percent, it will penetrate a quarter inch steel shell within six months at ordinary temperatures. In the face of this active rate of attack, and m spite of the fact that many organic materials in themselves are adequately inert the use of thin coating films is not advisable as undetected imperfections in the coating film, or subsequent film fracture by mechanical impact will expose the underlying metal and result in rapid perforation. Minimum lining thicknesses of & in. are desirable for production equipment, and where the selected lining does not possess adequate resilience to resist mechanical impact a carbon brick overlining should be installed.

For all concentrations below 98 percent and temperatures below 350 deg. F. the filled phenolics are in successful use. Filled furanes are also satisfactory. Filling materials of asbestos and silica and glass fabric reinforcement should be avoided. Carbon filled material is suitable.

Of the rubbers, hard or semi-hard material rubber is being successfully used at concentrations up to 40 percent and temperatures up to 150 deg.

F. The use of soft natural rubbers should be restricted to concentrations below 30 percent. Neoprene is the preferred rubber, in satisfactory use for concentrations up to 60 percent and temperatures up to 150 deg. F. Butyl rubber is equally suitable except for its lower temperature limits, 130 deg. F. Indifferent success is reported with buna S and N.

The thermoplastics—polyethylene, polystyrene, methacrylates, and vinyls—have all been used successfully within their temperature limitations, below 120 deg. F., at concentrations up to 60 percent. In the case of the vinyls, which resin is resistant, commercially available vinyl linings vary considerably in the type and amount of plasticizer and stabilizer. Inquiry or tests should be conducted to insure that these compounding materials are also resistant.

The Pennsylvania Salt Manufacturing Co., on whose experience this report has been verified, has standardized wherever possible on carbon brick linings over neoprene membrane, the former set in carbon-filled phenolic cement. (NOTE: Pennsalt is one of the leaders in the study and production of fluorine and fluorine compounds,—Editor).

#### Not Recommended

#### Chemical Stoneware

Chemical stoneware, in common with all siliceous products, is not suitable for use with HF under any conditions.—F. E. HERSTEIN, General Ceramics Co., Keasbey, N. J.

#### Tantalum

Tantalum is very rapidly attacked by hydrofluoric acid.—ALIAN L. PERCY, Fansteel Metallurgical Corp., North Chicago, Ill.

#### Glass-Lined Steel

Since present glass linings are based primarily on silicates, they are not recommended for use with hydrofluoric acid under any conditions. —S. W. McCann, The Pfaudler Co., Rochester, N. Y.

#### Aluminum

Hydrofluoric acid solutions are generally recognized as good etchants for aluminum; accordingly, aluminum alloss would not be selected as materials of construction for equipment to handle hydrofluoric acid.—ELLIS D. VERINK. JR., Aluminum Company of America, New Kensington, Pa.

NEXT MONTH . .

. . . Symposium on Fluorine

## By Using The Right VIKING DIIMD

#### VIKING PUMP FOR YOUR JOB

There is no compromise when you pick Vikings for your job. They are built in the most complete range of sizes and styles to give you the pump that will help you cut your pumping costs.

The Viking line assures you of the correct pump. No wasted power . . . no need to accept a pump not quite designed for your work . . . ar one a little too small . . . or one a little too large.



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Viking

PUMP COMPANY Cedar Falls, Iowa



You are pouring dollars down the sewer when you fail to reclaim "waste" water that might otherwise be used over and over again. In most cases this so-called "waste" water can be used as boiler feed or for cooling with a drastic reduction in your water bill and a simplification of your disposal problem.

Let Graver analyze your "waste" water problem today. Let Graver show you how the Reactivator (shown at right) will soften and clarify this water to a point where "waste" treatment becomes a profitable operation. Employed in connection with other Graver water conditioning units . . . pressure filters and ion exchange softeners . . . the Reactivator will produce boiler feed and cooling water at lowest possible cost.



#### GRAVER WATER CONDITIONING CO.

216 W. 14th ST., NEW YORK 11, N. Y.
CHICAGO . PHILADELPHIA . CLEVELAND

A DIVISION OF GRAVER TANK & MIG. CO. INC. EAST CHICAGO,





RECEIVING - Up to 8 boxcars of super-Phosphate, potash, sulphate of ammonia, etc., are unloaded each day. One oper. etc., are unloaded each any. The aper. ator can unload a 30 ton car in x nours, using a narrow  $5\frac{1}{2}$  foot dock and carry. using a narrow 312 toot dock and carrying a narrow 312 toot dock and carrying 55 ft. to a chute. Truckloads of incoming meat scraps and bones dumped in the had are scooped up and carried up a yara are scooped up and carried up a ramp into the plant bins by the Payloaders.

PRODUCTION - The fifteen different kinds of materials going into the products vary in nature—dusty, sticky, lumpy, ucts vary in nature—austy, sticky, tumpy, fine, hard, dry and slippery—yet all are tine, nara, ary and suppery—yer an are handled and rehandled readily by the nanated and renanated readily by the Poyloaders, which scoop them up from their bins and carry and feed them into conveyors, grinders and batchers.

MISCELLANEOUS - The versatility of Payloaders is valuable for the miscellaneous handling jobs that abound at this plant...clean-up work...snow removal looding trucks and cars ... handling oil drums ... moving, lifting, loading and dumping of different materials.

## "THERE'S Just No Limit TO THEIR USE"

**Payloaders Serve Every Phase of Operations** at Independent Manufacturing Company

This Philadelphia plant makes fertilizer, fertilizer bone meal, meat scrap feed, etc., and has a total of 5 Model HA Payloaders with 101/2 and 12 cu. ft. buckets. They were selected because they provided a flexible material handling system, combining the abilities required to operate inside a boxcar . . . dig and lift full bucket loads of the densest, hardest materials . . . transport them speedily indoors, outdoors and up ramps . . . dump them where wanted without manual help,

Company officials estimate that each Payloader does the work of a six man crew - without complaint. They say, "There's just no limit to their use. When you consider that all our materials are handled two or three times you can readily picture the savings made by our PAYLOADERS.

PAYLOADERS are unique in name, in design and in proven ability to save time, labor and costs on bulk material handling. It will pay you to get full facts. The Frank G. Hough Co., 702 Sunnyside Avenue, Libertyville, Illinois.



GET YOUR COPY OF Jab Study No. 13 - a complete authorized analysis of Payloader operations at this plant. IT'S FREE!





## Names in the News



MAN OF THE MONTH

W. B. Bell

A few days after you read this the American Section of the Society of Chemical Industry is going to homor one of America's outstanding industrialists. William Brown Bell, president of American Cyanamid Co., is to receive the Chemical Industry Medal for 1949 for outstanding contributions to the advance of chemical industry.

Mr. Bell was elected to his present position 27 years ago. Under his direction Cyanamid has grown to a company with 40 plants and 17,000 employees serving 200 industries. This growth has been due to his foresight. He saw the need for diversification accomplished by internal growth and direct purchase. Mr. Bell says of the company, "In 1922 the fertilizer business of American Cyanamid Co. was depressed—its phosphate rock mines in Florida were shut down. Its Ammo Phos plant in New Jersey was shut down. Its

cyanamid plant at Niagara Falls was operating at 14 percent of capacity. That was all and any fool could see that what we needed was diversification."

He also believed in expanding the company's interest and investment in research. It was his leadership that built up great research organizations at Stamford, Pearl River and Bound Brook covering all the fields from pure research to technical service and pilot plant work.

His beliefs paid off.
Friends and associates of Mr. Bell are
continually impressed by both his boundless energy and his capacity for work. He
is no swivel-chair administrator. He visits
plants, mines and laboratories. He knows
what is going on. And he is a stickler for
safety. He is interested in his employees—
their welfare, pensions, problems.

Apart from Cyanamid he is active in other fields. He is honorary vice president and a member of the board of NAM; was president of MCA for three years; was president of the Chemical Alliance for five years; is a trustee of Haverford College as well as the Duke Endowment Fund; is a director of the Sloan Foundation. In 1936 he was chairman of the finance committee of the Republican party. All his life he has devoted a great deal of his time to the preservation of the free enterprise system and the American way of life.

His work is both vocation and avocation. A second hobby, however, is vachting. This interest was climaxed in 1928 with the winning of the King of Spain's Cup Race. He sailed his 96-ft. schooner Elena from New York to Spain in less than 17 days.

The SCI is honoring a lawyer turned industrialist, a businessman who knows more chemistry than many chemists, a leader who has served his company and his country.

Miller W. Conn has been appointed assistant manager of Phillips Petroleum Co.'s chemical products department in Bartlesville, Okla. Dale Fischbeck succeeds Conn as service engineer of the company's Perco division.

Raymond B. Cross has been made manager of the Paulsboro catalyst plant of Houdry Process Corp.

Francis R. O'Brien has been appointed head of the engineering division of Southern Research Institute, Birmingham, Ala. Mr. O'Brien was formerly with the University of Alabama as director of

the Engineering Experiment Station.

E. D. Anderson has been made chief engineer in the heat exchanger division of the Western Supply Co., Tulsa, Okla.

S. J. Rini has been appointed chief of the fat and oil research section of the Kraft Foods Co.'s research staff. He was formerly on the research staff of Lever Bros.

Jack Compton has been appointed head of the chemistry department of the Institute of Textile Technology at Charlottesville, Va. John Happel is the new chairman of the department of chemical enginecting at New York University's college of engineering. Dr. Happel has been professor of chemical engineering at the college for a little more than a year. Prior to that he was a chemical engineer with the Socony-Vacuum Oil Co. for 18 years.



J. Happel



K. Kammermeyer

Karl Kammermeyer has been appointed professor of chemical engineering and head of the division of chemical engineering of the University of Iowa, Iowa City, Iowa. He was formerly manager of research and development of the Glenn L. Martin Co.

Alfred G. Susie, formerly chief chemist at Marbon Corp., Gary, Ind., has been appointed supervisor of plastics research at Armour Research Foundation of Illinois Institute of Technology.

Bernard Rudner has joined the technical staff of the Rensselaer, N. Y., plant of General Aniline & Film Corp.

William F. Hester, former director of insecticide and fungicide research of the Rohm & Haas Co., Philadelphia, has been named administrator of the fellowships of Koppers Co., at Mellon Institute.

Bernard F. Langer has been made manager of structural and heat engineering for Westinghouse Electric Corp.'s atomic power division. Erling Frisch has been made manager of control engineering.

W. R. Graham, Jr., has been named director of research by the Quaker Oats Co., Chicago, to supervise (Continued)

#### A Thrifty Mixer



#### FOR CHEMICALS, FOODS and OTHER LIQUID MATERIALS

You'll save time and money by using Eastern mixers in your laboratory and production processes. Whether used in experimental or run-of-themill applications, Eastern mixers blend and mix economically over long periods of service. Every Eastern mixer is factory pre-tested for precision and performance. All are guaranteed by the manufacturer.



MODEL H-1 Heavy duty 1/4 H.P. High speed— 1725 R.P.M. 30" shaft dual 4" low pitch props.

Available in models from 1/20 to 5 H.P. Motors are sleeve-bearing; totally or semi-enclosed or explosion-proof. Screw clamp or bracket mounting. Stainless steel shaft; nickel plated bronze props. Easy to clean, dependable and maintenance-free.

WRITE FOR FULL DETAILS



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NAMES IN THE NEWS, COURT . . .

chemical, pharmaceutical, and nutritional research. Dr. Graham had been with Cerophyl Laboratories, Kansas City, Mo.

- J. W. Britton has been appointed head of the new technical service division of Surface Chemicals, Inc., Pittsburgh, Pa.
- Mearl A. Kise has been named director of research and development of the Virginia Smelting Co., West Norfolk, Va. Mr. Kise was formerly assistant chief of research for the Solvay process division of the Allied Chemical and Dye Corp.





M. A. Kiw

N. H. Parker

- Norman H. Parker has joined the Robinson Brothers Chemicals, Inc., staff as superintendent of the company's Brooklyn, N. Y., plant. He was formerly associated with the National Lead Co. research laboratories.
- E. W. Luster has been appointed manager of the Esso engineering department of Standard Oil Development Co. C. E. Paules, formerly associate chief engineer, succeeds Mr. Luster as chief engineer of the department.
- James P. Fugassi, professor of chemistry at Carnegie Institute of Technology, Pittsburgh, Pa., has been appointed acting head of the department of chemistry.
- F. Curtis Tucker, formerly assistant purchasing manager of the Rohm & Haas Co., has been appointed manager of purchases for the chemical division of the General Electric Co., Pittsfield, Mass.
- J. Earl Harrington has been appointed executive secretary of the Western Society of Engineers.
- George R. Greenbank of the United States Department of Agriculture has received the Borden Award in the Chemistry of Milk presented by the American Chemical Society. The society has also presented the new (Continued)

Here's A <u>Better Way</u> To Read Water Levels Of Inaccessible Boiler Drumsl



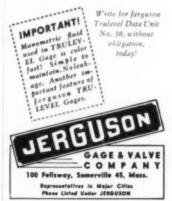
### JERGUSON TRULEVEL GAGES

For All Distant Reading Problems

JERGUSON TRULEVEL Gages are the ideal solution to your problem when you need to read boiler water level accurately at a distant point, as in the case of inaccessible waste heat boilers.

TRULEVEL brings the liquid level reading of water, or of any condensing medium which you may be using, right down where you can see it. Complete accuracy of reading is assured by the use of a new type datum column, located at the drum.

Quick checking at the distant reading point is another important feature of TRULEVEL, and this is patented and exclusive with Jerguson. By simply turning the two valve handles on the cover it is possible to check gage accuracy in a matter of seconds. For accuracy and safety use the Jerguson TRULEVEL.



## ACCURATE RECORDS with

## **Hagan Ring Balance Flow Meters**

In many flow metering applications, there are considerable periods when flow is only a very small percentage of maximum. Nevertheless, it may be highly important to have a reliable record of flow at all times, including these low flow periods.

You can get such records with the Hagan Ring Balance Flow Meter.

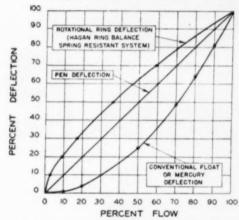
This low-flow response is inherent in the design of the Hagan Ring Balance Meter. The ring, pivoted on a knife-edge bearing, moves in response to extremely low differentials, and this ring movement is proportionately greater at low flows than at high.

Since flow is a square root function of differential pressure, all orifice type meters require correction of the movement of the measuring element in order to produce a linear chart. In conventional meters, the correction is a multiplication of this movement, and hence a multiplication of any error. In Hagan Ring Balance meters, however, the corresponding ring movement is greatest at the lower end of the scale. Therefore possible inaccuracies are minimized instead of multiplied on the chart record.

For full information on this and other features of Hagan Ring Balance Meters—including Dual meters which record two flows on a single chart—write to Hagan Corporation, Hagan Building, Pittsburgh 30, Pennsylvania.

#### DEFLECTION CHARACTERISTICS

#### HAGAN RING BALANCE METER



Graph shows how compensating mechanism of Ring Balance meters reduces movement of pressure responsive element, while in conventional meters this must be magnified to produce a linear flow chart.



#### HAGAN CORPORATION

RING BALANCE FLOW AND PRESSURE INSTRUMENTS
THRUSTORQ FORCE MEASURING DEVICES
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| COMPANY                           |                          |
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vier-Bath Screw Pumps and Gearex Pumps are designed to do a job-and keep doing it. The manufacturer has a full appreciation of the high cost of interrupting the operation of a line to permit pump repairs. On the Internal Gear-type Screw Pump, for example, the gland is the only point of attention and as this is on the suction side, it is almost negligible. It is not unusual for the packing to last two years without repacking. The pressure on the gland is so slight that it is possible to add a new ring of packing without shutting down the unit. Send for information.

ALSO MAKERS OF SIER-BATH PRECISION GEARS

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MEMBER A. G.M. A.



HUDSON BLVD NORTH BERGEN, N J

NAMES IN THE NEWS, cont. . .

Precision Scientific Co. Award in Petroleum Chemistry to Bruce H. Sage, professor of chemical engineering in the California Institute of Technology.

Robert D. Coghill, director of research of Abbott Laboratories, North Chicago, Ill., has won the 1949 Midwest Award of the St. Louis section of the American Chemical Society.

William B. Brown, former research director for Pittsburgh Coke & Chemical Co., Pittsburgh, Pa., has been named general superintendent. James E. Sincell and Wallace A. Shelby have been named assistant superintendents. R. E. Christ has joined the research staff as director of plasticizer development. John E. Sigler has joined the staff to work on problems of air and water pollution.





W. B. Brown

D Heldman

Julius D. Heldman has been transferred to the research laboratory at the Houston refinery of Shell Oil Co. He was formerly chief research chemist at the company's Wilmington laboratory.

J. A. Almquist and R. L. Hershey have been named assistant general managers of the polychemicals department of Du Pont. The polychemicals department is the result of a consolidation of the ammonia and plastics departments.

Hayden H. Jones, Jr., Norman D. Phillips and Earle F. Young, Jr., have joined the chemical laboratory of the research and development department of Babcock & Wilcox Co., Alliance, Ohio.

John H. Rollins, formerly on the staff of the Chemical Corps School, Army Chemical Center, Md., has been assigned as chief of the technical services division, Technical Command, Army Chemical Center. Robert J. Classen has joined the (Continued)



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## By Popular Request— A Standardized Multipurpose Heat Exchanger

Recognizing an urgent demand for a small, multipurpose heat exchanger we have stend-ardized on what we believe is the optimum designed for almost universal application—heating, cooling, and condensing. This standard Whitlock Type 1-R-2 stainless steel tube side unit shown above is now available for prompt skipment.

#### WIDE RANGE OF CAPACITIES

The exchanger is fabricated in 3 shell sizes and 3 tube lengths to provide a total of 9 selections ranging in size from 8 to 50 sa, ft. Where more surface is required multiple units may be connected in series or parallel.

#### MATERIALS OF CONSTRUCTION

The shell is of steel, with Type 304 stainless steel tubes (% OD x 18 BWG), tube, sheet, and cast channel. Baffle spacing of 3" develops reasonably high shell side velocities.

#### U-TUBE DESIGN

The Whitlock Type R or U-tube construction allows operation with relatively high differential shell and tube side temperatures—permits individual thermal expansion. The U-tube design, suitable for a wide range of service, also makes a unit that is law in cost. This Type 1-R-2 Exchanger may be exectly what you want—write today for additional information.



#### pure, uniform caustic soda











#### to meet your strictest requirements

Wyandatte Caustic Soda, as produced by the Mercury Cell method, meets the highest standards of quality. Commercially, it is free from sodium chloride, sodium chlorate, iron and practically all other impurities.

In the manufacture of rayon and other products—wherever high-grade caustic soda is essential—this truly fine chemical can be used as delivered, without further processing. Its purity and uniformity do not depend upon the efficiency of a purification system.

Recently completed facilities have enabled us to double our previous production of Mercury Cell Caustic. If your chemical needs include quality caustic soda, why not write us today?

Wyandotte Chemicals Corporation Wyandotte, Mich. • Offices in Principal Cities

SODA ASH • CAUSTIC SODA

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CHLORINE • HYDROGEN • DRY ICE

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AROMATIC SULFONIC ACID DERIVATIVES

OTHER ORGANIC AND INORGANIC CHEMICALS



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Designing data on . for more efficient process plants

CHEMICA

ENGINE

PLANT

LERE'S up-to-date, usable information on
the design of technically and
economically efficient chemical
process plants—from laboratory stage through pilot plant
stages to commercial size unit.
This is a guidebook for the engineer, executive and technician who
want practical information and data
step, including provisions for equipment, storage, illumination, hearing,
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location, etc.

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By FRANK C. VILBRANDT Head, Dept. of Chemical Engineering, Virginia Polytechnic Inst.

618 pages, 6 x 9, 104 illustrations 201 tables, \$6.00

MeGRAW-HILL CHEMICAL ENGINEERING SERIES

THIS book shows how to carry out a complete de-lign project, applying chemical engineering prin-iptes to every cles from initial laberatory experiments un to the specifications and out figures for the com-sertal vize add.

Memmint vize unit.
Every factor that influences plant location, layout,
construction, and undertion of equipment is taken on
an experience of the second of

e types and capacities of unit operation

netalization of water, steam and chemical biping and installation of water, steam and chemical biping and comping systems, spewer transmission, materials, labor, water supply, servisions for regarsten, and majoritals handling are only a few of features of the plant devian problems discussed folish here.

\*\*Explaints\*\*

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HELPFUL TABLES

Over 200 practical data tables commarize pertinent data all every step in the development of a specific project, giving you accurate time - saxing information. More than 100 line drawings and photographs provide clear Historican to further simplify the axplanations.

PARTIAL CONTENTS — Foundations, Drainage, Piping, Installation, Pumps, Power, Flow Dia-grams, Plant Layout and Elevation, Preconstruc-



NAMES IN THE NEWS, CONT. . .

Air Force Munitions Branch, munitions division, as a chemical ordnance engineer.

Ernest D. Wilson, head of the department of chemical engineering and chemistry at Worcester Polytechnic Institute has been appointed to the board of registration for professional engineers for Massachusetts.

Robert E. Wagner has been appointed assistant professor of chemical engineering at Worcester Polytechnic Institute, Worcester, Mass. John H. Beckwith and Leonard W. Fish have been appointed graduate assistants.

Henry O. Pond, district purchasing manager with the H. K. Ferguson Co., has reentered the private practice of consulting engineering. He will retain connection with H. K. Ferguson in a consulting capacity.

Arnold H. Johnson has been named director of research at National Dairy Research Laboratories Inc., Oakdale, L. I.

Ray H. Moore has joined the staff of the Claude B. Schneible Co. as a special consultant.

Robert A. Harte has been appointed research administrator, medical research division, Sharp & Dohme, Inc., Philadelphia.

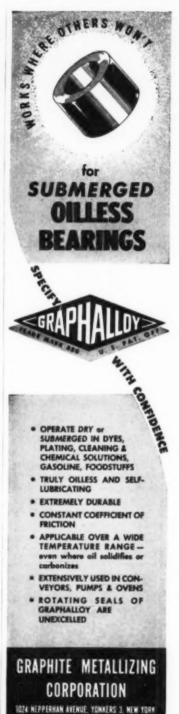
Frank J. Aschenbrenner and Earl C. Clark have been appointed assistant directors of research and engineering for Air Reduction Sales Co. Mr. Aschenbrenner will be in charge of the Air Reduction Murray Hill, N. L. laboratory.

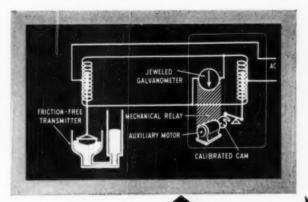
C. V. Mace and John M. Blickle, chemists, have been added to the staff of the applied physics laboratory of Johns Hopkins University, Silver Spring, Md.

Morris A. Steinberg has been elected to the board of directors of Horizons Inc. of Princeton, N. J.

W. H. Sheffield, Jr., has been elected president and general manager of Innis, Speiden & Co., New York. He succeeds his father who died recently.

George E. Holbrook has been named assistant director of the technical division of Du Pont's organic chemicals department in Wilmington. John E. Cole will replace Dr. Hol-(Continued)







## Tops!...for accuracy,

READABILITY, LOW MAINTENANCE . . . . FLEXIBLE USEFULNESS . . . .

## **HAYS-PENN** Flow Meter

Extreme accuracy that stays accurate is the chief characteristic of the Hays-Penn Flow Meter; and the "reason why" is exceedingly simple:

 the friction-free float transmitter serves only as a pilot—does no work of recording—actuates the auxiliary motor which does the work of operating the recording pen, indicator and integrator

No stuffing boxes, no bearings, no electric contacts, no solenoid reactions—that is why Hays-Penn Flow Meters maintain

their matchless accuracy through long periods with a minimum of maintenance. Hays-Penn Flow Meters are made for every metering need.



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Booths 729-734...4th Floor
Exposition of Chemical Industries
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November 28 through December 3, 1949



VICTOR CHEMICAL WORKS

141 West Jackson Boulevard, Chicage 4, Illinois

Names in the News, cont. . .

brook at the company's Chambers works at Deepwater Point, N. J. Edgar W. Thompson has been named manager of the neoprene chemical rubber plant at Louisville, Ky., to replace Emory F. Ridlon who has been placed in charge of tetraethyl lead manufacture at the Chambers works.

John T. Castles has been made manufacturing engineer of General Electric's silicone plant in Waterford, N. Y.

Philip Heiberger has been appointed senior lacquer chemist of the Stamford, Conn., branch of Atlas Powder Co.'s industrial finishes department.

Martin Kuna has been added to the staff of the department of antibiotic research of Sharp & Dohme, Inc., Philadelphia. Peter A. Tayomina has joined the department of biochemical research.

Edgar Collins Bain, vice president in charge of research and technology at the Carnegie Illinois Steel Co., has been awarded the John Price Wetherill Medal of the Franklin Institute of the State of Pennsylvania.

James J. Doheny has been appointed manager of the Chicago section of the American Chemical Society.

Hendley Blackmon, formerly managing editor of Electrical World, has been appointed assistant manager of engineering association activities for Westinghouse Electric Corp., Pittsburgh, Pa.

James R. Harrington has been appointed assistant branch manager of the Cleveland, Ohio, office of Monsanto 'Chemical Co.'s phosphate division. Howard Lovejoy has become assistant branch manager of the Birmingham, Ala., sales district. Lloyd D. Shand has been made a sales representative in the company's New Jersey territory for the Merrimac division.

Paul M. Isbill has been appointed assistant general manager (administration) of the Texas Co.'s domestic sales department. S. C. Bartlett has been named assistant general manager (sales).

Edward H. Wyckoff, Texas sales manager of Diamond Alkali for the last 15 years, has resigned to go into business for himself. He has or-(Continued)

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**Welded Construction** 



"METALSMITHS" Reinforced

## STAINLESS STEEL BATCH CANS

METALSMITHS Batch Cans are made of type 304 stainsteel, butt welded by the heliarc process, using no filler rod or flux. Top is reinforced by an endless iron ring, with handles attached. Stainless steel is flanged over edge of top ring and down 14" on outside. Iron chime encircles the base, with bottoms reinforced by an iron cross welded to chime. 10 to 75 gallon sizes in stock. Also available in other analyses stainless, monel, inconel and pure nickel. Send for illustrated price sheets.

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(ASPIRATORS, EDUCTORS, EXHAUSTERS, MIXERS, ETC.)

Have Many Advantageous Uses in the Chemical and Process Industries



A simple jet pump operated by steam, water or air, the Penberthy Ejector has no moving parts and requires no lubrication. It is very unlikely to get out of order and wear is not appreciable. Other advantages of this jet type pump are that it is practically noiseless, very reliable, compact, convenient and has low initial cost.

Widely used in the chemical and process industries, Penberthy Ejectors are made from ½" to 6" pipe sizes with screwed or flanged connections. They are made in bronze, iron and a wide variety of materials that successfully withstand corrosion, contamination and high temperatures. Special units are designed and manufactured to meet unusual conditions. Your inquiries are solicited. Write for Catalog 34.

## PENBERTHY WATER HEATER



Penberthy XL-32 Water Heater (Open Tank Type) uses steam to heat water or other liquids to any temperature up to boiling (212° F) . . . quietly and without surging or pounding. Operating steam pressures range from 3 to 140 psi at the heater nozzle. Made of high grade bronze. Sizes are from 12" to 2". Write us regarding special heaters for unusual conditions.

3949

# PENBERTHY

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**Liquid Level Gages** 



### REFLEX

Due to "Reflex" principle, liquid always shows bleck and empty space white. Liquid level is indicated instantly and unmistakably. Made in any length desired of temperature resisting alloy steel for high pressure and temperature service. Conforms with API and ASME requirements. Ask for now Cotalog 35.



### TRANSPARENT

Glass front and rear permits observation of color and density of liquids under high pressures and/or temperatures. Highest quality—made of temperature resisting alloy steel in any length required. Conforms with API and ASME requirements. Ask for new Catalog 35.

# PENBERTHY INJECTOR COMPANY

DETROIT 2, MICHIGAN

Established 1896

Canadian Plant, Windsor, Ontario



# LOOK WHAT'S HAPPENING

on the Texas Coast

# NEW HOUSTON QUARTERS FOR FERGUSON

The H. K. Ferquson Company has recently bought property in Houston and is drawing plans for an eight-story. \$2,000,000 building of its own. Ferquson is one of the nation's top aames in the design and construction of chemical and other industrial plants. It is the first firm in its field to erect its own office building kere, and this move is indicative of the importance Houston is assuming as the new center of the nation's chemical industry.

## NEW LINSEED OIL PLANT FOR HOUSTON

South Texas Cotion Oil Company. Technical Oil Division, has completed construction of a new building where linseed oil will be polymerised for use in the manufacture of synthetic drying oils. Production started August 15, 15,000 lbs. of linseed oil is being produced at a single charge, and output will ge mainly to Texas paint and varnish manufacturers.

# TALL TALE ... BUT TRUE

"I suppose you account for the speed of the football players in Texas by claiming that when they were boys they ran down rabbits for the family table." on Eastern sports writer said.

toble." on Eastern sports writer said.
"Not exactly," replied the Texas coach. "They not only had to be fast enough to catch the rabbit, but they had to be able to reach down while running alongside and feel him to see if he was plump enough to eat."

### CALL THE ROLL ...

of the big names in the chemical industry — Du Pent, Alcan, Monsanto, Shell Chemical Cerp., and many others — you'll find them all on the Texas Gull Coast, Attractions are unlimited quantities of acids, bases, fresh water and cheap NATURAL GAS for fuel and hydrocarbons: reasons why your industry can profitably FOLLOW THE TREMD TO TEXAS.

To help you find out more about the area we serve, we will gladly: (a) make a survey engineered to your company's needs; (b) supply you with any special information you require; (c) show you the coast country from Sobine to Rio Grande rivers — all in strictest confidence. Write, wire or telephone the Houston Pipe Line Company, Houston, Texas.

# LHOUSTON PIPE LINE CO.

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Natural @AS

NAMES IN THE NEWS, CORT. . .

ganized the Texas Chemical Supply Corp. at Houston. The new corpotation will be jobbers of heavy chemicals, cleaning compounds, absorbent materials and industrial maintenance supplies.

C. Victor Mars has been named manager of the new product department, Ansul Chemical Co., Marinette, Wis. Robert J. Yaeger succeeds Mr. Mars as sales manager of the industrial chemical division.

Robert B. Reynolds has been transferred from the San Francisco office of Taylor Instrument Cos. to Chicago where he has been made assistant manager.

Harry W. Fieberts has been added to the development engineering staff of Lukens Steel Co., Coatesville, Pa., as a sales engineer to specialize in paper machinery.

Shelby A. McMillion has been appointed assistant to the vice president in charge of sales, Chicago Metal Hose Corp., Maywood, Ill.

T. K. Wells has been appointed assistant to the vice president in charge of sales. E. L. Hiter has been made manager of sales for the Eastern division and A. W. McGuire, manager of sales for the Western division.

J. K. Hamilton has been named manager of apparatus research division, Air Reduction Sales Co., at the research laboratory in Murray Hill, N. J., H. O. Klinke has been made assistant manager. J. T. McKnight has been appointed superintendent of production and services section and T. J. Cholis has become supervisor of patent section.

Orum R. Kerst has been placed in charge of the northeastern sales district of E. F. Houghton & Co., Philadelphia. J. R. Clendenning has been placed in charge of the southeastern district.

Malcolm S. Adler has been made district manager for the Cleveland office of the F. J. Stokes Machine Co., Philadelphia. John C. Meyer, Robert Platt and Richard V. D. Strong have been made managers at San Francisco, Philadelphia and Chicago, respectively.

Charles E. Sharp has been made Chicago branch industrial manager for Brown Instruments division of Minneapolis-Honeywell Regulator (Continued)

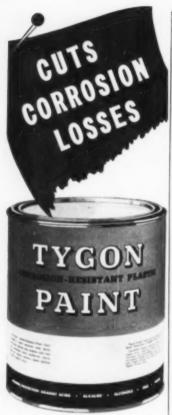




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Mail to Taylor Forge & Pipe Works P.O. Box 485, Chicago 90, III.



TYGON plastic Paint protects metal, concrete and wood from attack by acids, alkalies, oils, fresh or salt water. Tough, flexible film resists impact. Non-contaminating to solutions.

Write for Test Samples



NAMES IN THE NEWS, CONT. . .

Co. John A. Robinson has been named regional sales manager for the Midwest, Northwest, Rocky Mountain and Pacific Coast areas. Charles D. McIntire has been named industrial sales manager of the Cincinnati branch office. John E. MacConville has been named industrial sales manager of the Atlanta branch.

Frederick A. Fielder has been appointed general manager of the Bar-Way Co, of Stamford, Conn.

Eric G. Peterson has been made general manager of Peabody Engineering Corp., New York.

J. H. Sheehan has been appointed manager of all petroleum sales for Lion Oil Co., El Dorado, Ark. Leroy Donald has been made administrative assistant (chemical sales) to the vice president.

R. J. Caccavelli has been made manager of the Superior Electric Co., Bristol, Conn., Chicago sales office.

T. R. McGovern has been appointed to handle heating and ventilating products in the Los Angeles territory for Modine Mfg. Co., Racine, Wis.

Arnold R. Beardsley has been put in charge of sales of the Takamine Laboratory, Inc., Clifton, N. J.

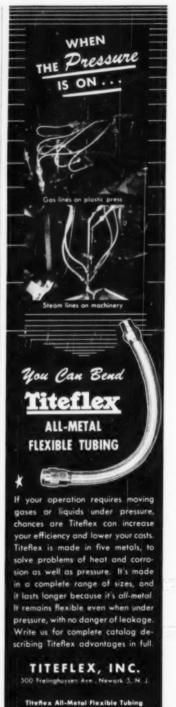
Robert L. Allen has been made district manager of the Cleveland office of Fritz W. Glitsch & Sons, Tulsa, Okla. Allan Persson has been made manager of the Chicago office.

Carl K. Mead has been appointed assistant to the sales manager of the chemicals division of General Electric Co., Pittsfield, Mass. Harold G. Deters succeeds Mr. Mead as sales manager of alkyd resin products.

Kenneth H. Mac Watt has been appointed director of engineering sales of L. O. Koven & Brother, Inc., Jersey City, N. J.

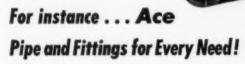
John H. Selby has been made sales representative in New Orleans for Oronite Chemical Co.

Kasper Peter has been made manager of the Chicago district of Phillips Chemical Co.'s fertilizer sales division. Harold R. Krueger has been made director of the division's technical service. Clarence J. Ball has (Continued)



# ACE HARD RUBBER and PLASTICS

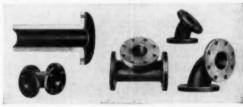
STOP CORROSION AT ALL VITAL SPOTS



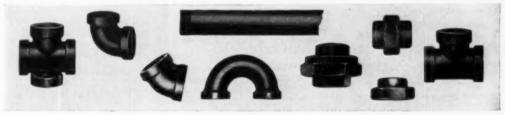
Here's the most complete line of hard rubber and plastics pipe and fittings you'll find anywhere. Ace hard rubber resists all alkalies, metallic salts of inorganic acids, hydrochloric acid any strength, nitric acid up to 16° Baume, phosphoric acid to 75%, sulphuric acid up to 50° Baume, most other inorganic acids any strength, and countless other corrosive solutions and fumes. Other Ace plastics such as Saran and Parian (polyethylene) extend this range of applications still further. Catalog 300-7 and Ace plastics bulletins tell you where Ace-clad and Ace molded equipment saves for you—send for them today.



Saran tubing and tube fittings from 1/8 to 3/4".



HARD RUBBER LINED STEEL: Completely protected over flanges as shown in cutaway view above. Pipe available in sizes from  $1\frac{1}{2}^{\prime\prime}$  up. Cast iron and steel flanged fittings  $1\frac{1}{2}^{\prime\prime}$  up.



SOLID HARD RUBBER: Standard pipe and threaded fittings from  $\frac{1}{4}$  to  $\frac{4}{1}$ ; larger sizes to  $\frac{8}{1}$  on special order. Flanged fittings also available from  $\frac{1}{4}$  to  $\frac{6}{1}$ .

|        | FILL | IN  | AND  | MAIL | THIS | COUPON | FOR | ACE | PIPE | BULLETI   |
|--------|------|-----|------|------|------|--------|-----|-----|------|-----------|
| ACE    |      | Nam | e    |      |      |        | Tit | le  |      |           |
| TILY A |      | -   |      |      |      |        | Ci  | ly  |      |           |
| COV ma | MER  | 110 | AN H | ARD  | RUE  | BER CO | MPA | NY  | . n  | MERCER ST |



CHEMICAL ENGINEERING—October 1949

# EXHAUST HOT OR CORROSIVE GASES FROM EXTREMELY HOT AREAS WITH--



Where super-heated areas are likely to impair the operation of electric motors or hot, corrosive and inflammable gases create a safety hazard—the BIFURCATOR Roof Ventiator is recommended. Mounted on the roof, these units assure efficient discharge of gases and full accessibility for maintenance. Operare with or without ducts. Available in sizes from 1,990 to 43,200 cfm. Alzo special corrosion-resistant construction.



HOW PERATES

Cut-away view shows passage of gases around motor which is mounted in separate chamber, open to atmosphere, yet isolated from exhaust fumes.



Certified Ratings

All performance ratings are obtained from accurate wind trunnel tess made in accordance with Standard Test Code of the PFMA and ASHVE for Axial Flow Fans.

for Complete Details — Catalog gives specific data on expecities, sizes, etc.

DE BOTHEZAT FANS DIVISION, DEPT. CE 10 American Machine and Metals, Inc. EAST MOLINE, BLEMDIS Please rush complete data on BIFUR-CATOR Roof Ventilator.

| Firm          |        |   |
|---------------|--------|---|
| Address       |        | _ |
| City and Zone | State_ | _ |

ALDER HUSBAND SALTA PARK

NAMES IN THE NEWS, CORT. . .

been made manager of the Norfolk, Va., district. R. D. Evans has been appointed manager of the Houston district. A. Wayne Peck has been made sales representative in the anhydrous ammonia section with headquarters in Bartlesville. Okla.

- C. Benson Branch has been named manager of the technical service and development division of Dow Chemical Co., Midland, Mich.
- Richard J. Both has been assigned to special duties in the insecticide division, Hercules Powder Co., Wilmington, Del. James H. Neal has succeeded Mr. Both as toxaphene technical service and sales representative in the Southeast.
- Fred W. Fuller has joined the Claude B. Schneible Co. to serve as a specialist for the dust and fume equipment industries.
- W. E. Conkright has been made sales promotion and advertising manager of the General Controls Co., Glendale, Calif.
- F. S. Mott has been made manager of manufacturing at the Ridgway, Pa., division of the Elliott Co.
- Frank X. Banko has joined the Radio Frequency Laboratories, Inc., Boonton, N. J. as assistant sales manager. William W. Follin has been made field engineer for the Washington, D. C., area.
- L. E. Pennington has been appointed the representative to the petroleum industry for the Reynolds Metals Co., Louisville, Ky.
- Charles C. Brooks has been appointed southeastern representative of the Pressed Steel Tank Co., Milwaukee.
- H. F. Whitler has been appointed sales manager of the fatty acid department of the chemical division of Armour and Co., Chicago, Robert S. Haley has been made assistant sales manager. K. E. Johnson has been appointed sales manager of the derivative department.
- John C. Toomey has been made a district sales engineer in the Detroit office of Chain Belt Co. of Milwankee.

George E. Hardy has been appointed to the pharmaceutical sales staff (Continued)



How would you like to turn your whole problem over to one responsible firm? Forget all the timeconsuming details?

your plant!

YOU CAN-

with Enasco! We are equipped to handle your entire problem of plant expansion from initial studies to going operation!

### HERE'S HOW!

EBASCO is a team of many seasoned engineers, constructors and business consultants. When we approach your plant expansion problem we start with an economic study of your needs ...move logically to the succeeding steps ...plant location...plant design ...construction ...equipping ...pilot production .equipping ...pilot production .employee training ...business systems ...even continuing operation if you choose!

### EBASCO

does the whole job...or any single part of the job. We work with your engineers and executives to produce an end-product that is the one best answer...and the most efficient ...for your expansion needs.

If you'd like a complete outline of Enasco's individualized services as engineers, constructors, and business consultants, write for our booklet The Instite Story or Outside Help. We'll send it to you promptly.

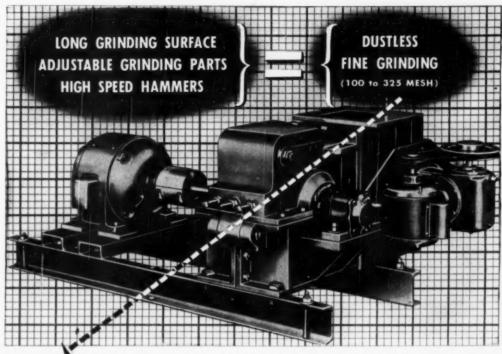
EBASCO SERVICES

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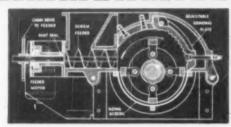
Accessing a Appraisal - Budget - Consulting Engineering Carpensio Finance - Design & Construction - Leakustical Relations Impection & Expediting - Insurance - Purchasing - Rains & Printing Research - Sales & Markeling - Tuers - Traffic



# WILLIAMS HELIX-SEAL HAMMERMILL

NO FANS, CYCLONES OR SEPARATORS. Material fed into screw feeder is discharged at bottom of mill completely pulverized...with no oversizes or tailings to be separated. Screw feeder also acts as a seal against inrush of air. No dust! Williams' Helix Mill grinds many materials to 325 mesh. 100 to 200 mesh products are common on more difficult materials. Yes! It'll grind wet and sticky materials, too! Variable speed control permits grinding of different kinds of materials. EASY, INEXPENSIVE TO INSTALL AND OPERATE! Small floor space and lack of vibration calls for simplest of installation. Only requirement is a tight bin below mill with some sort of outlet. All parts are easily cleaned... on most materials simply by brushing. Feeder drive consists of roller chain drive from fractional horsepower gear head motor to feeder screws.

WILLIAMS PATENT CRUSHER & PULVERIZER CO. 2706 N. NINTH STREET ST. LOUIS 6, MO.



Sectional view of Helix-Seal Mill. Note long grinding plate against which the material is ground before it reaches the sizing screen. This plate is adjustable to compensate for wear.

### WILLIAMS ALSO MAKES . . .

Heavy-duty hammermills; impact and roller mills for 200 to 325 mesh grinding; drier mills; air separators; vibrating screens; steel bins; complete "packaged" crushing and grinding plants.



# THE BEST COILS for Heating and Cooling H,SO, are

# KNAPP PROCESS HOMOGENEOUS Pb COVERED COPPER COILS

OR the first time such coils are available with all of these features: Low cost! Higb corrosion resistance! Excellent beat transfer! High physical strength! Fabricating economy! Simplicity of repair! Excellent fatigue resistance!

HOMOGENEOUS Lead Covered copper coils improve on the performance of other mediums (when used to heat or cool H<sub>2</sub>SO<sub>4</sub> and solutions).

Compared with the hard metals: Better corrosion resistance! Better beat transfer! Lower initial cost! Longer life!

2 Compared with lead pipe coils: Better beat transfer! Lower initial cost (or great improvement in beating cycle, at your option)! Extended life as coils are rigid and will not fatigue or collapse under temperature cycles!



# KNAPP PROCESS

Homogeneous Lead Covered copper tubing is fabricated on homogeneous lead-covered steel legs. Such legs eliminate unsatisfactory lead spacer blocks. They provide rigid construction and permit the tubing to expand and contract freely.

# Operating Data

Coils may be operated at steam pressures up to 150 psi and the homogeneous bond between copper and lead will withstand up to 500°F. The strength of the coil in respect to internal pressure and rigidity relies solely on the copper tubing, thus the homogeneous lead covering may be kept at a minimum.

Tubing available in lengths or coils for your own fabrication



SEND FOR

a sample of homogeneous Pb covered copper as produced by the Knapp Process. No obligation.

KNAPP MILLS, INC.

125 BROAD ST., NEW YORK 4, N.Y.

PLANTS AT Wakefield, Mass. - Long Island City. N. Y.

Nervistews, Fa. - Wänington, Bel. - Baltimoir, Md.

NAMES IN THE NEWS, CORT. . .

of Dow Chemical Co., Midland, Mich.

Samuel B. Applebaum has been made manager of the cold process water treating division for the Cochrane Corp., Philadelphia.

David H. Jackson has been made general manager of Croll-Reynolds Co., New York.

Paul Hexter, vice president in charge of sales of Arco Co., Cleveland, has resigned.

John B. Hayes has been appointed sales representative for the electrode division of Great Lakes Carbon Corp., Niagara Falls, N.Y.

### OBITUARIES

T. L. B. Lyster, 70, former chief engineer of the Hooker Electrochemical Co., Niagara Falls, died August 18 of a heart ailment after a short illness.

Alphonso L. Ivey, 65, president and general counsel of the Virginia-Carolina Chemical Corp., died on August 18.

Walter G. Scharmann, 45, a senior engineering associate in the development division of Standard Oil Development Co., died in Westfield, N. J., August 24.

George F. Kroha. 50, vice president and general sales manager of the Pfaudler Co., died August 31 in Cleveland, Ohio.

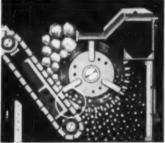
A. Donald Cummings, 45, for the past 13 years chief chemist of the Collyer Insulated Wire Co., Pawtucket, R. I., died in Providence on September 1.

Charles W. Cuno, consulting chemical engineer of St. Louis, Mo., died September 9.

Edward Ledoux, an engineer formerly with the Attapulgus Clay Co. of Philadelphia, and author of several books on adsorption and numerous articles for Chemical Engineering, died on September 18 at Latrobe, Pa., where he made his home.

Sterling Diggs, 69, died last month in his home at the University of Virginia in Charlottesville. Before his retirement, he had been a chemist for the Standard Oil Co.





Extended Moving Breaker Plate construction (illustrated) guards against passage of oversize material . . . results in improved grinding control.

# Your Assurance of Greater Production at Less Cost

The one and only Dixie NON-CLOG Moving Breaker Plate Hammermill\* sets a new standard of crushing efficiency in the reduction of wet, sticky materials.

If you have wet, sticky material to crush, if you have difficulty in reaching and maintaining desired production, if you have ony crushing problem at all, it will pay you to take advantage of this vastly improved crushing principle.

Dixie Non-Clog Hammermills are made in sizes ranging from 24" up to 72" diam.

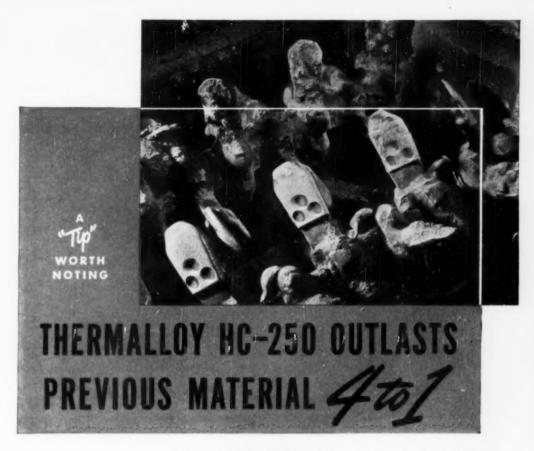
WRITE TODAY FOR COMPLETE INFORMATION

\* U. S. Patente Granted & Pending



MACHINERY MFG. CO

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GET THE FACTS about Thermalloy HC-250. This new bulletin gives advantages, properties, suggested applications. The unretouched photograph above shows that Thermalloy\* HC-250 can really "take it" under extreme abrasion conditions.

Formerly the mixer tips and end liner plates of this asphalt blender had to be replaced at least twice each season. Downtime is costly with seasonal work of this type. Then Thermalloy HC-250 was tried.

This photograph was taken after two complete seasons. The mixer tips show some wear, but still have many months of service life left. End liner plates are still in excellent condition—do not need replacement.

In addition to its abrasion resistance, which is surpassed only by expensive hard facing materials, Thermalloy HC-250 withstands temperatures up to 1800°F and can be annealed for machining.

Why not find out how Thermalloy HC-250 can help solve your abrasion problems? Call in your nearest Electro-Alloys engineer, or write for bulletin T-176. Electro-Alloys Division, 1994 Taylor Street, Elyria, Ohio.

Specify THERMALLOY® for heat and abrasion resistance . . . CHEMALLOY® for corrosion resistance.

\*Reg. U. S. Pat. Off.



ELECTRO-ALLOYS DIVISION

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OFFICES IN PRINCIPAL INDUSTRIAL CITIES

# INDUSTRIAL NOTES

Standard Oil Co. (Ohio) has announced that Sohio has engineering work under way that may lead to the construction of a \$4,000,000 crude oil distillation unit in Cleveland. Plans are also being discussed for an increase in the capacity of the catalytic cracking plant at the Cleveland refinery.

Pan American Petroleum Corp. of New Orleans has merged with its subsidiary, Root Petroleum Co. of Shreveport, La., to form Pan-Am Southern Corp. President of the new corporation will be Bruce K. Brown, now president of Pan American Petroleum Corp.

Magnolia-Airco Gas Products Co. is now carrying on the business formerly conducted by Air Reduction Sales Co. in the southwest region of the United States.

Container Corp. of America, Chicago, has announced that its subsidiary, California Container Corp., has leased the folding carton machinery and equipment of the Bemis-Jason Co., San Francisco. Bemis-Jason will continue to manufacture its line of corrugated specialties at its present location.

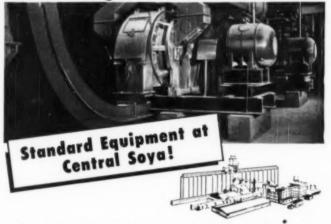
Metal Hydrides Inc., Beverly, Mass., has completed additional units for the manufacture of lithium aluminum hydride. This material, heretofore confined to laboratory and research quantities, is now commercially available.

Bowen Engineering, Inc. has moved its business offices to North Branch, N. J. The company was formerly located in Garwood, N. I.

Ampco Metal, Inc., Milwaukee, has appointed W. P. and R. S. Mars Co., Duluth, Minn., as distributor of its products in northern Minnesotta, upper peninsula of Michigan and the northern counties of Wis-COUNTY

General Flectric Co., Pittsfield, Mass., has established a warehouse for servicing midwestern G-E Glyptal alkyd (Continued)

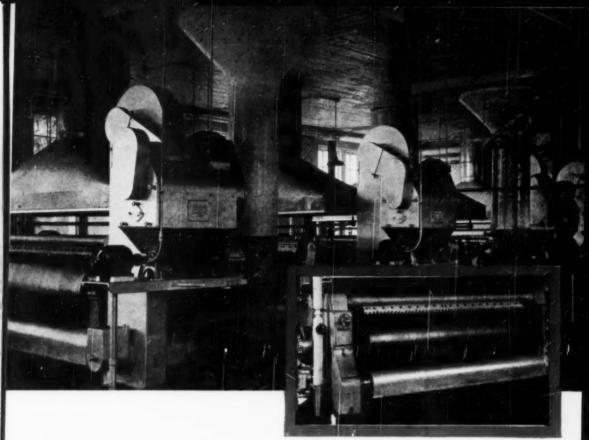
# THE PRATER DUAL-SCREEN PULVERIZER



A leader in the development of the solvent process of extraction, Central Soya Co., has contributed much to the improvement of equipment used in the process. The design of the Prater Dual-Secret Pulverizer, for ex-ample, is based to a considerable exten-upon the recommendations of people who

As a result, the Prater Dual-Screen Pul-

verizer is standard equipment at Cent Soya's Solvent Extraction Plants at Gibs City, Illinois; Decature, Indiana; a Marion, Ohio. Il you are working with this process, will pay to standardize on the equipm that's built to do the job most efficiently a economically. Write: Prater Pulverizer C 1317 South 55th Court, Chicago 50, Illino



# LOW upkeep despite HIGH temperatures

Gears and bearings on the hot rolls of the milk-drying machines shown above operate at temperatures around 250°F.
 Proper lubrication requires an oil that will withstand oxidation and excessive thinning at these high temperatures.

On this job, Stanoil Industrial Oil has fully met the severe lubrication requirements. During the ten years Stanoil has been

> STANOIL Industrial Oil

used, no lubricated part of the dryer rolls has needed repair or replacement. Gear cases have remained free of sludge. While the oil has been changed each year as a matter of operating routine, Stanoil has shown practically no deterioration in service.

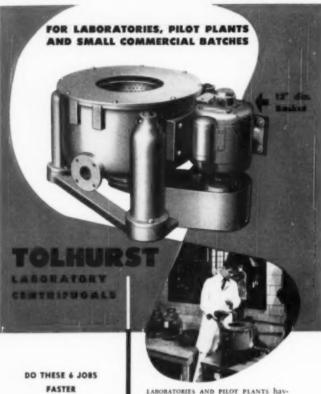
Stanoil can handle many difficult jobs for which special products are often thought necessary. It provides clean and dependable operation in speed reducers, hydraulic units, and a wide variety of circulating systems. It owes this versatility to effective oxidation-resistant and anti-foam additives combined with the highest quality solvent-extracted base stocks.

Why not find how Stanoil can save you the cost of special oils and simplify stocking problems? A Standard Oil Lubrication Engineer will be glad to help you.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

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- . CLARIFYING
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ing small batches of chemicals or pharmaceuticals to extract find Tolhurst "Center-Slung" Laboratory Centrifugals practical, economical and ideally suited to this purpose. These small but efficient models save floor space, time, labor and cost.

Tolhurst Laboratory Centrifugals have adjustable, variable speeds. Basket is 12" in diameter and can be constructed of stainless steel, monel, bronze or steel rubber covered. Cases may be jacketed for circulation of coolant or steam.

LABORATORY SERVICE AVAILABLE -For confidential, unbiased and intelligent recommendations on your centrifugal problems, consult Tolhurst with its well-qualified staff and modern research facilities.

WRITE FOR PRICES AND CATALOG complete with it



INDUSTRIAL NOTES, CORT. . .

resin accounts at the Decatur, Ill., plant of the plastics division of the company.

Moore Products Co., Philadelphia, has opened a branch office in Los Angeles. Calif. The new office will be headed by H. E. Wheeler.

Western Supply Co. of Tulsa has opened a branch office for its heat exchanger division in the West Bldg. in Houston, Tex., with Frank M. Gibbons as manager.

Detrex Corp., Detroit, has combined its industrial product engineering, estimating, quotations, orders, and customer field services under T. J. Kearney, chief engineer in the equipment division.

General Controls Co., Glendale, Calif., has opened a factory branch office in Cincinnati, Ohio, to service southern Ohio, southeastern Indiana and central Kentucky. It will be headed by Jack Prutow. The Oklahoma City branch office has been moved to Tulsa.

De Laval Steam Turbine Co., Trenton, N. J., has opened a midwestern district office in Chicago. C. C. Bray has been named to manage it.

Harry T. Campbell Sons' Corp., Towson, Baltimore, has appointed new broker distributors. They are: Jensen & McClelland, Chicago; Baker & Collinson, Detroit; Smead & Small, Cleveland; Worum Chemical Co., St. Paul, Minn.; and Pigment and Chemical Co. Ltd., Montreal, Canada.

Mechanical Industries, Inc., has been formed in Pittsburgh, Pa., to be headed by Morton I. Dorfan. The new engineering company will limit its activities to industrial ventilation, smoke, dust and fume control.

Edward Valves, Inc., East Chicago, Ind., has completed new metallurgical, physical, and chemical laboratories. The laboratories will be devoted exclusively to steel valve research.

Russell Mfg. Co., Middletown, Conn., has started negotiations to open a branch plant in Bennettsville, S. C.

Westinghouse Electric Corp., Pittsburgh, Pa., has formed a special products development division that will bring new products from the research to the commercial produc-(Continued)

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# OZALID

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"From Research To Reality"

| Name    | and Ozalid Streamliner. |
|---------|-------------------------|
| Company |                         |
|         |                         |
| Address |                         |



INDUSTRIAL NOTES, CONT . . .

tion stage and will handle special military developments. The division will be headed by Frank W. Godsey, Jr.

Dorr Co. will move its main office, now located at 570 Lexington Ave., New York, to Stamford, Conn., in the Northam Warren Bldg. on Barry Pl.

Graver Tank & Mfg. Co., New York, has established the Graver Water Conditioning Co. as a division of the company to extend the operations which have been conducted by the Graver water conditioning and process equipment department.

Equipment Clearing House Inc. has been formed by former employees of First Machinery Corp. with the cooperation of that company. The new firm will engage in the purchase and sale of equipment for the processing of chemicals, food and kindred products. Offices will be in Brooklyn.

Tamms Silica Co., Chicago, has incorporated under the new name of Tamms Industries, Inc.

Claude B. Schneible Co. has appointed A. G. Hobson exclusive representative for the sale of foundry equipment in Maine. New Hampshre, Vermont, Massachusetts and Rhode Island. His offices will be in Malden, Mass.

Ram Inc., Detroit, has been formed to sell a plastic pressing process to the ceramic industry.

Pittsburgh Coke & Chemical Co., Pittsburgh, Pa., has opened an office in Tuba, Okla., for its protective coatings division, to serve the central Midwest. Frank E. McNulty will manage the new office.

Merck & Co., Rahway, N. J., will conduct its export business under the name Merck (North America) Inc.

Borg-Warner Corp., Chicago, has sold its Superior Sheet Steel division plant, near Canton. Ohio, to the Louis Berkman Co., Steubenville, Ohio.

Jas. P. Marsh Corp., Skokie, Ill., has purchased the electrimatic valve division of Simoniz Co. of Chicago.

Union Bag & Paper Corp., New York, has opened a new multiwall bag sales office in New Orleans, La. —End

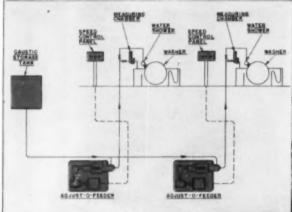
# PUSHBUTTON PROCESSING



%Proportioneers, Inc.% Chemical Feed Systems Combine Accurate Feeding with Extreme Flexibility in Control

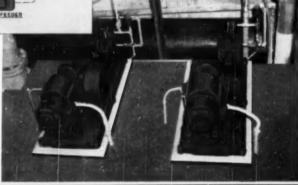
If your process involves treating, sampling, blending or diluting, %Proportioneers, Inc.% Chemical Feeding Systems offer the versatile, economical method for performing these operations. Here is an installation in a pulp mill where

%Proportioneers% Adjust-O-Feeders, remotely located, are controlled from the point of application by positioning devices which permit infinite rate adjustments from 9.8 to 98 GPH against 100 psi. The pumps are conveniently out of the way near the caustic storage, leaving the floor space at washers open and unencumbered. Progressive plants in all industries are improving their competitive position with %Proportioneers, Inc.% modern push button processing. Write for bulletins or recommendations.



All equipment shown red in photo and flowgram furnished by %Proportioneers, Inc.%

% Proportioneers % variable delivery Adjust-O-Feeders metering caustic at Brown Corporation, LaTuque, Quebec.



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DRUMS

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# CONVENTION PAPER ABSTRACTS

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The United Nations has been holding scientific conferences on the conservation and utilization of resources. For Chemical Engineering readers we present abstracts of a baker's half dozen. More next month.-Editor

### PETROLEUM

. . . Trends in Oil Chemistry Leon Jacque

In the past 25 years and the last 10 in particular there has been an increased development in the use of petroleum fractions as chemical raw materials.

This development appears to hold no threat for the conservation of natural resources, as the resulting consumption is very small in proportion to the other uses of petroleum.

The structural features of petroleum have special advantages in regard to chemical operations.

"Oil chemistry" proper consists in the production from petroleum, by cracking, slight structural modification and synthesis, of organic compounds, pure or in simple combination, or of the products of polymerization of the condensation of hydrocarbons.

Although petroleum accounts for perhaps one half of the world organic ynthesis industry computable at less than 12,000,000 tons, its corresponding consumption is little more than 1 percent of the total production.

The conversion of natural gas or the gasification of liquid fractions also serves to produce reducing gasescarbon monoxide and hydrogen, with an exceptionally favorable thermic balance; these gases may be used in metallurgy and in organic or mineral synthesis (ammonia). Developments (Continued)





construction specialists for the outhwest

If there is an industrial frontier in America today, it certainly lies in the rich, bustling Southwest. Brown & Root, Inc., started here more than 30 years ago. Our long association with the terrain, soil, working conditions, and people of this vast empire has established Brown & Root as this section's foremost construction and engineering company. There is no substitute for experience, and if you have Southwestern plans, Brown & Root can help you.



BROWN & ROOT, Inc. Engineers - Constructors

CABLE ADDRESS - BROWNBILT

Associate Companies:- BROWN ENGINEERING CORP. . BROWN & ROOT MARINE OPERATORS INC.



# 1. LOW INSTALLATION COSTS:

Water lines are quickly assembled . . . pipe crews lay more pipe per day . . . when Transite Pressure Pipe is used for factory water lines-because Transite is light, easy to handle . . . because joints are easily made and readily checked during assembly . . because deflections up to 5 degrees at each joint permit laying pipe around curves without special fittings.



# 2. LOW OPERATING COSTS:



Transite Pipe has a smooth interior surface that offers minimum resistance to flow of water. Furthermore, its initial high flow capacity cannot be reduced by tuberculation-the internal corrosion that reduces the flow capacity of ordinary water pipe. This helps assure high pressures and an ample volume of water for future requirements . . . helps keep pumping costs low.

# 3. LOW MAINTENANCE COSTS:

Transite Pressure Pipe is made of asbestos and cement by a special Johns-Manville process that develops exceptional resistance to corrosion. This has been substantiated in numerous industrial water lines and is an index of the long service to be expected of Transite Pipe. In addition, Transite's tight, flexible joints guard against costly underground leakage-further assurance of low water-line maintenance over the years.



For further information write for booklet "Engineering Facts about Transite Pressure Pipe." Address Johns-Manville, Box 290, New York 16, N.Y.

Johns-Manville **NSITE PRESSURE** for Water Supply Lines . for Fire Lines . for Process Lines CONVENTION PAPERS, COURT . . .

along these lines are taking place in the United States and in several industrial European countries.

Increasing quantities of methane or liquid fractions are being converted into hydrogen and carbon monoxide. Twenty percent of French natural gas will contribute to the nitrogen industry, and this is likely to increase.

Leon Jacque, French Petroleum Insti-tute, before United Nations Scientific Conference on the Conservation and Utili-zation of Resources, New York, May 23, 1949.

### CHEMURGY

. . Promises

Ernst D. Bergmann

It is obvious that from the point of view of modern industry, only such agricultural products are of interest which are obtainable in large quantities and large yields per unit area. The fact that these prerequisites were not fulfilled for most of the natural dves and drugs was one of the stimuli for research in the synthetic field.

Carbohydrates are being produced by the green plants from carbon dioxide, the end product of all those metabolic and industrial processes which are based on natural carbon compounds, both of the living and of the manimate world. In using carbohydrates, therefore, we only perform one step in a cycle. In using petroleum or coal, we are destroying irreversibly a material which ultimately was formed by the same forces as the carbohydrates.

A fairly large number of reagents have been employed in the attempt to convert carbohydrates into normal industrial chemicals. Cellulosic materials are said to have been treated on a commercial scale with alkali under high pressure and at high temperature and have thus been transformed into liquid mixtures of hydrocarbons and oxygenated compounds which served as motor fuel.

However, it appears that a much more elegant method for such a conversion consists in the utilization of bacteria instead of chemical reagents. The complicated enzyme systems of the bacterial cell permit the transformation of carbohydrate into a very large number of useful chemicals, useful by themselves or by virtue of their transformability to other products, characteristic of the organic-chemical industry.

Special attention should be given to the so-called acetone-butyl alcohol fermentation which converts starch or

(Continued)

# CONINCONEL

At home in 2200 degree heat or protecting delicate Chloromycetin... this modern high-Nickel alloy solves many of industry's most troublesome metal problems.

# NOMINAL CHEMICAL COMPOSITION

|          |    |   |   |   |   |   | (1 | W | fr | e | u  | 19 | įŘ | 18 | ) |   |   |   |   |   |   |   |   |   |       |
|----------|----|---|---|---|---|---|----|---|----|---|----|----|----|----|---|---|---|---|---|---|---|---|---|---|-------|
| Nickel   |    | , |   | * | , | , | ,  | * |    |   |    | ,  |    | *  | × |   |   |   |   |   |   |   |   |   | 77.   |
| Chromium |    |   |   |   |   |   | 0  |   |    |   |    |    | e  | 0  | 0 |   | 0 |   |   |   |   |   |   |   | 15.   |
| Iron     |    | D |   |   |   | 0 |    | 0 |    |   |    | 0  | 0  |    | 0 | a |   |   |   | 0 | 0 |   |   |   | 7.    |
| Manganes | е. | , |   | 0 | 0 |   | 0  |   | 0  | 0 | 0  | 0  | ٥  | 0  | 0 | 0 | ۰ | ۰ | 0 | 0 | 0 | 0 | 0 | 0 | 0.25  |
| Copper   |    |   | × |   |   |   | 2  | 8 | 8  | × | ×  |    | *  | ×  | × | × | × | * | × | * | × | æ |   | 4 | 0.2   |
| Silicon  |    | 8 |   | 8 | 8 | 8 | 8  | 8 |    |   | 70 |    |    |    |   | * |   | * |   | * |   | 8 |   |   | 0.25  |
| Carbon   |    |   |   |   |   |   |    | * | *  | , | ×  | 6  |    |    |   |   |   |   |   |   |   |   |   | * | 0.06  |
| Sulfur   |    |   |   |   |   |   |    |   |    |   |    |    |    |    |   |   |   |   |   |   |   |   |   |   | 0.007 |

### PHYSICAL CONSTANTS

| Density, lb./cu. in   |
|---|
| Melting Range   |
| Specific Heat (77°-212°F.)0.109                                 |
| Thermal Expansion Coefficient in./in.<br>(100°-200°F.)0.0000064 |
| Thermal Conductivity (100°—212°F.)  Btu/sq. ft./hr.°F./in       |
| Modulus of Elasticity in tension and compression, psi31,000,000 |
| in torsion, psi   |
| Poisson's Ratio   |

### MECHANICAL PROPERTIES

Figures shown are for standard cold-rolled sheet, hard. Variations will occur for different forms and tempers.

## **AVAILABLE FORMS**

| Wire     | Bor              | Plate          | Pipe    |
|----------|------------------|----------------|---------|
| Rod      | Angles           | Sheet          | Strip   |
|          | Seamless and v   | velded tubing  |         |
|          | Sand and prec    | ision castings |         |
| Clad-Ste | el Plate and Str | n Weldi        | na Rods |

Combining remarkable thermal durability, corrosion-resistance and strength...Inconel® is unique among metals.

Inconel is a thoroughly practical metal: workable, economical, readily available in many convenient forms.

Inconel...and only Inconel...brings you all these desirable properties in a single alloy:

- Unusually high resistance to chemical corrosives, both hot and cold, such as fatty and other organic acids, caustic alkalis at high temperatures, hot alkaline sulfides and strong chloride solutions.
- Exceptional stability in the presence of food acids, cultures, ferments, alcoholic beverages — minimizing the danger of harmful metallic contamination.
- Ability to withstand constant temperatures of up to 2200° F., in sulphur-free atmosphere.
- High strength, both hot and cold.
- Good spring properties, especially valuable in high-heat applications.
- Good workability...can be machined, cast, forged, formed ...can be joined by welding, brazing, or soldering. Welded joints are as corrosion and heat-resistant as the alloy itself. Inconel is also available in the form of clad-steel.

Next time you have a high-heat or corrosion problem ... try Inconel.

Inco's Technical Service Department will gladly make design and fabrication recommendations.

For a valuable addition to your reference files, write for Bulletin T-7, Engineering Properties of Inconel.



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Let us show you how others have effected economies and improved their finished product through the use of MIKRO grinding and dust collecting equipment specially designed for the Chemical Processing Industry.

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If you have a pulverizing or dust control problem, our engineers will study it, telling you what our equipment and the MIKRO-Plan can do for

you. There is no charge for this service which is based upon thousands of tests and performance records.

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trated catalog and information regarding our uncharged-for laboratory service to help you solve your pulverizing and dust collection problems.

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PRESERVE OUR HERITAGE: FAITH, FREEDOM AND INCENTIVE

CONVENTION PAPERS, cont. . .

sugar into a mixture of acctone, butyl alcohol and ethyl alcohol because these three substances are, at least virtually, hydration products of the three olefines, propylene, butylene and ethylene, on which most of the modern petrochemical processes are based.

Another biological process which appears to hold out great promise, although it has hardly been used industrially, is the methane fermentation, because it gives the possibility not only of producing a fundamental hydrocarbon, but also of basing on carbohydrates all those transformation reactions of which methane is capable. It is of particular interest that the methane fermentation can use cellulose as starting material.

Another distinct advantage of bacterial fermentation is the fact that its results can be influenced, at least to some extent, by modification in the nutrient solution on which the bacteria are acting. This has become particularly interesting in such cases as the production of various penicillins; but a similar effect is known also in the more common fermentations, for instance in the acetone-butyl alcohol fermentation in which an addition of acetate and butyrate to the fermenting mash leads to an increase in the amount of acetone and butyl alcohol produced by the bacterial cell.

It does not appear impossible that systematic application of principles and experience already gained may lead to a revision of current ideas on the paramount value of petroleum and coal, and may thus help in the pacification of a troubled world. In any event, these methods may certainly become a tool in the development of those areas which lag behind in their industrial development and in the standard of living of their population.

Ernst D. Bergmann, Weizmann Institute of Science, Izrael, before United Nations Scientific Conference on the Conservation and Ctilization of Resources, New York, August 18, 1949.

### CORROSION

# . . . Costs and Control

W. H. I. Vernon

Hadfield's estimate (1922) of the annual world cost of steel and iron wasted by rusting, of the order of £600,000,000, is well known and frequently quoted. Speculative in large part though such estimates must be. no one can doubt that the aggregate economic loss due to corrosion is enormous, particularly bearing in mind that to the actual loss of metal must (Continued)

# TANKS for Industry



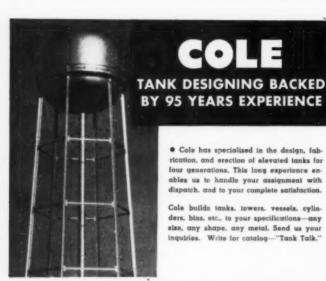
# Recognition

comes only to those who cling to the highest manufacturing standards...who insist and prove that their products deliver the utmost in dependability and quality. For half a century, Q.C.f. has been recognized as an outstanding builder of tank cars, storage tanks and processing equipment. That's why Q.C.f. is a good name and a good name to remember.

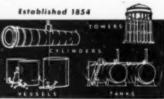
AMERICAN CAR AND FOUNDRY COMPANY, NEW YORK - CHICAGO - ST. LOUIS CLEVELAND - PHILADELPHIA - WASHINGTON - PITTSBURGH - SAN FRANCISCO

CHEMICAL ENGINEERING-October 1949

269



R.D.COLE
MANUFACTURING CO.
NEWNAN, GA.



# FILTER UNITS

fabricated by MULTI-METAL

No filter unit is too big—or too small to receive complete handling right in the Multi-Metal plant. The oversize filter basket (shown) features a fine plain Dutch type filter cloth. It is all stainless steel. Complete fabrication was handled by Multi-Metal. The unit is reinforced by heavy 3x3 screen backing. A flat bar frame support is reinforced by vertical fins. All arc welding is done by the "Heliarc" process. For suggestions on your specs and price quotes, try Multi-Metal.



Multi-Meta

WIRE CLOTH COMPANY, INC. 1350 Garrison Ave., New York 59, N. Y. More than 35 years of service to process industries

CONVENTION PAPERS, CORT. . .

be added, to complete an economically vicious circle, the still greater amounts of ore, fuel and fluxes used up in its replacement. In many other cases material loss is subordinate to the wastage of time and effort for which corrosion is responsible.

Estimates of corrosion economics are probably more safely applied to the cost of protective measures, particularly if the field be restricted geographically. From a statistical analysis of the total wrought iron and steel production of the United Kingdom for 1936, Hudson deduced the approximate total surface area and concluded that if the whole of this area had been painted with two coats of paint, approximately 32,000,000 gal. of paint would have been required, representing a total cost, including that of the necessary labor, of £40,000,000. Revised figures (1949) place the total cost of corrosion prevention of iron and steel for the United Kingdom alone at the startling figure of £200,-000,000 annually.

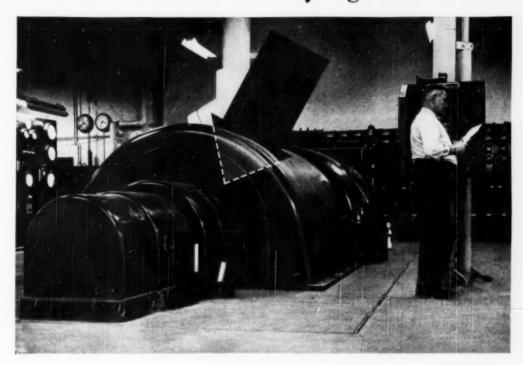
It should be borne in mind, however, that wastage of metal is by no means the only economic factor to consider. Frequently, corrosion may lead to heavy losses of other materials or heavy increases of power necessary to maintain supplies. An important example of this indirect effect is the reduction of carrying capacity of pipes through the formation of insoluble corrosion product. In many other cases material loss is subordinate to the wastage of time and effort for which corrosion is responsible.

Foodstuffs and other packaged goods are contaminated by corrosion products, water and gas are wasted by leakage, chemical processes are impeded, structural safety factors are augmented, and throughout industry there is loss of efficiency, risk of breakage or explosion, and all the consequent elaborate and costly routine of periodical inspection. In other words, the aggregate cost of corrosion control has probably increased relatively to that of corrosion. On this question, much depends upon the life of the structure as determined by factors other than corrosion, and the initial cost of protection must be balanced against the number of years the structure is expected or required to last.

Measures such as phosphate treatments which increase the adhesion of the paint are clearly advantageous, since in general they contribute to both objects. On the other hand, in the chemical industry, the prolongation of the life of a vessel is clearly of major importance and relatively ex-

(Continued)

# Under the skin of many a generator...



# ... fire threats are smashed with CO2

Like thousands of other generators in power plants all over the world, these two units of The Ohio Box Board Company at Rittman, Ohio, are protected against the threat of fire by Kidde<sup>2</sup> Built-in Systems.

If fire should start inside one of these generators, a heavy initial discharge of carbon dioxide (CO<sub>2</sub>) from the Kidde System can extinguish any active flame within a few seconds. No danger that damage to the insulation will spread!

To prevent any possibility of a reflash, a continuing discharge of CO<sub>2</sub> maintains an inert, fire-suffocating atmosphere inside the generator during the run-down period.

Of course, there's no extinguishing-agent damage with a Kidde System. The CO<sub>2</sub> does not corrode metal or harm insulation.

Do you have a fire-protection problem? Whatever its nature, a Kidde representative will help you.

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# For Maximum Service with Minimum Maintenance!

One of the country's leading chemical plants installed a Tidewater Red Cypress acid washing tower (illustrated above) many years ago. They report that this tower has given outstanding service through the years with exceptionally law maintenance costs.

Exhaustive tests by several Government Agencies show that Tidewater Red Cypress is particularly resistant to the action of on chemical solutions. This wood also

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CONVENTION PAPERS, CORT. . .

pensive methods of protection become economically practicable; for example, stainless steels may take the place of cheaper materials as a substantial ultimate economy.

Another matter of considerable importance is that of accessibility. Thus, expensive protective methods which may not be justified where parts of the structure can be easily reached for periodical maintenance may become economically expedient and highly desirable if access can be gained only by the expenditure of much time and effort. Underground pipelines afford

a good example.

Emphasis has so far been placed upon the metal. Consider for moment a major economic aspect of environment. It is noteworthy that the corrosivity of the atmosphere is very largely man-made. So far as "natural" factors are concerned, atmospheric corrosivity should diminish as the distance from the sea increases. In so far, however, as the approach is made to towns or to populated areas precisely the reverse obtains and it is in such districts, where most of the world's fabricated metal is concentrated, that corrosion, with all its concomitants. is by far the most severe. We are contributing heavily to the destruction of metal economically as precious as the coal that is consumed or, alternatively, to the cost of preventing that destruction.

W. H. J. Vernon, Department of Scientific and Industrial Research, England, before United Nations Scientific Conference on the Conservation and Utilization of Resources, New York, June 30, 1849.

## CHEMURGY

# . . . Food, Medicine and Fuel

G. E. Hilbert

The word "Chemurgy" was coined about fifteen years ago to express with convenient brevity a complex ideathe idea of developing new industrial uses for farm commodities, of establishing new crops to supply industrial markets, and of making profitable use of farm wastes and residues. Chemurgic objectives include the development of wider markets for farm-grown materials and the creation of riches from the soil."

It appears that modern techniques of food preservation constitute one very important field of chemurgic effort. Converting fruits and vegetables into more stable form by canning, freezing, and other methods lengthens the season and expands the area in which these perishable farm

(Continued)





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Photograph of screen from lower side, showing backing plate.

Some processes require so fine a screen that unless supported it could not withstand normal operations. To make it possible to use screens with extremely fine perforations. Hendrick furnishes backing plates, as shown in the illustration. This stainless steel screen has .060" round perforations. The

backing plate is steel with 1" perforations, and does not need to be changed when the screen is renewed.

Whatever kind of screening your manufacturing processes involve, let Hendrick quote on screens made to meet your specific needs.



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CONVENTION PAPERS, CORT. . .

products can be made available, thus providing wider markets for the farmer and greater food resources for consumers. It is also a partial answer to some of our most persistent farmsurplus problems—the geographical and seasonal surpluses of perishable crops that often occur in limited areas for short seasons.

The most spectacular recent advances in food preservation have been made in the field of frozen foods. They now make it possible for most housewives in the United States to serve fruits and vegetables of many kinds virtually "field fresh" at any season. One new product, the result of applying a new principle of food preseravation, is frozen concentrated orange juice. Its production this year -some 7 or 8 millions gallons-will consume about 10 percent of the orange crop in Florida, as well as a portion of the California crop. Both grape and grapefruit juices are now processed commercially in this way. The new method of concentration and freezing might be extended with advantage to other fruits, particularly some of those produced in the tropics.

Another development of considerable promise, now in an advanced stage of experimentation, is "dehydrofreezing." This process combines the virtues of quick-freezing fruits and vegetables with the advantages of reduced weight and bulk made possible by partial dehydration. Dehydrofrozen peas, apples, apricots, and other products have excellent flavor and are easy to reconstitute in the kitchen. They occupy only about half the space in frozen storage and have about half the weight of conventionally frozen products. Experimental results show that the additional costs involved in drying are more than offset by savings in packaging, transporting, and storing these new products.

Besides giving us new techniques of food preservation, chemurgy has contributed greatly to our wealth of "creatable resources" through the processing of farm products to obtain starches, sugars, oils, proteins, and other constituents that can be used in the manufacture of foods and feeds and as industrial raw materials. The wet-milling of corn, or maize, and the processing of soybeans and other oilseeds are major chemurgic enterprises of this kind.

Perhaps the most important chemurgic development in the United States during the last few years has been the tremendous expansion in the fermentation industries, which proluce antibiotics, feed yeast, vitamins, (Continued)

# CELANESE Announces ISOBUTYL ALCOHOL

Celanese" isobutyl alcohol is now in commercial production at the CHEMCEL plant near Bishop, Texas. Up to now in limited supply,

In addition to its uses in brake fluids and as a solvent, isobutyl alcohol has unique applications—as a raw material for certain resin types, plasticizers, and special esters.

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Electrodeposited to any "mesh" from 25 to 400, with any proportion of open area from 10% to 50%, in widths up to 36" and as long as you want—LEKTROMESH runs constant in close adherence to the tightest specifications—and we can make it in any pattern and shape the wildest designer can dream up. Readily adaptable to the widest variety of critical filtering problems—to unique decorative use—or, perhaps, to applications no one has yet thought of.

CONVENTION PAPERS, cont . . .

industrial alcohol, and other needed products. A great impetus was given to developments in this entire field by the discovery of penicillin and the perfection of methods for the largescale production of this vital drug by submerged-culture fermentation.

A tremendous amount of work is being done in the United States to develop new and cheaper methods of producing alcohol and to utilize it as motor fuel. Perhaps the most significant development in this field, which may be of interest to many countries, is the use of alcohol as an anti-knock agent in engines by direct, automatic injection into the engine manifolds of automotive vehicles.

G. E. Hilbert, United States Department of Agriculture, before United Nations Scientific Conference on the Conservation and Utilization of Resources, New York, Aug. 24, 1949.

# **LEKTROMESH**



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1. POINTER

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Send for Bulletin F1-1

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# CONSERVATION

# . . . With Heat Pumps

Emory N. Kemler

Utilization of the heat pump in the United States has progressed rapidly during the past two years. There are probably over 150 residential units installed in homes in this country and over 200 units in use in commercial buildings. These vary in size from 550 to 3 hp. Installations have been made in at least 32 states. In those areas where cooling becomes desirable, enthusiastic response to the heat pump has been reported.

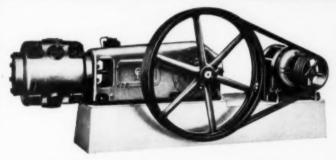
The heat pump in the United States has been used as a space conditioning device to give cooling when required, as well as heating. The industrial uses which offer large fuel savings have not developed in this country mainly because of the availability of low cost basic energy in the form of coal, oil or gas.

The future of the heat pump is primarily dependent on the extent and direction of research activities on the various problems associated with it. The most important problem which needs to be solved in so far as the general usage of the heat pump is concerned, is that of heat sources. While no simple and universal heat sources have as yet been developed, there are many possible lines of attack on this problem so that there seems to be little doubt that some development which will solve this need of the heat pump industry will be developed which will make the heat pump a universal type of equipment. Continued (Continued) years of satisfactory service

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This horizontal, straight-line, double-acting, moderately rated compressor is noted for continuous, economical operation . . . low maintenance . . . long life.

Its special features include Simplate valves . . . liberally waterjacketed cylinder and heads . . . adjustable, tapered roller main bearings . . . double-counterweighted crankshaft.

CP Type T Compressors are furnished in single stage units from 89 to 1937 c.f.m., 15 to 125 H.P., with V-belt, flat belt, and direct-connected synchronous motor drive. Multi-stage designs for pressures up to 5,000 pounds, and steam-driven types are also available.

Write for Bulletin 728-7

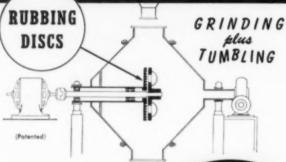


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"The Conical MUENCH

Mixer solved our most

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UNIFORM particle dispersion and thorough blending of dry materials, powder or granule, before or after pulverizing, in one operation.

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CONVENTION PAPERS, cont. . .

developments which will result in simplification of equipment and controls, reduction of size and cost, and increase in coefficient of performance are to be expected. These developments will improve the competitive position of the heat pump, result in more satisfactory performance and reduce energy requirements.

Emory N. Kemler, Southwest Research Institute, before United Nations Scientific Conference on the Conservation and Utilization of Resources, New York, April 21, 1949.

### CORROSION

. . . Costs in U. S.

Herbert H. Uhlig

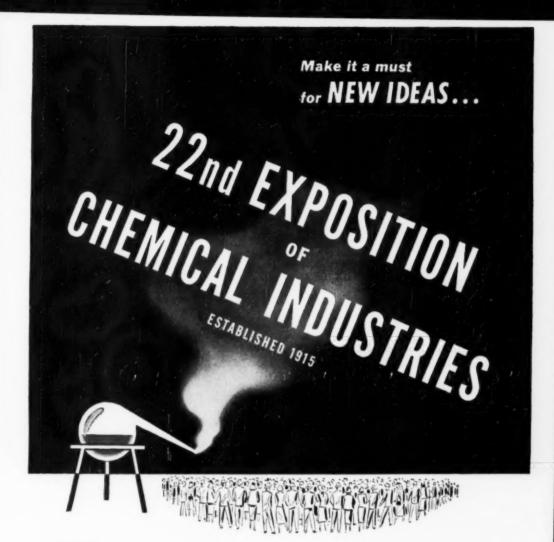
Economic and material loss through corrosion of metals is divided into direct loss resulting from replacement of corroded equipment, and an incalculable, often higher, indirect damage or loss through shut-down, overdesign, loss of product and efficiency, explosion, and contamination.

Direct loss by corrosion, although amenable to analysis, still is difficult to estimate. A survey of this kind is almost always incomplete, and is subject to a wide range of interpretation. Nevertheless, it is believed that annual cost to the United States, amounting to over \$5,500 million, represents the present-day tax exacted directly by the ravages of corrosion, and is the correct order of magnitude.

Not all of the material loss can be prevented. Metals persist in reverting to their ores or to compounds of lower energy despite corrosion protection. And possible reduction of economic loss is limited by the continuous or periodic upkeep required of all protective measures notwithstanding, much more can be accomplished through further scientific and engineering application to this problem, involving, as it does, conservation of materials and human effort. Only 1 percent improvement means the saving of 50 to 60 million dollars annually and thousands of tons of critical metals.

Indirect losses are not possible to estimate, and are not subject to even an educated guess. This is particularly true since they include loss of life and limb, and psychological factors attending unpredictable failure or explosion. Furthermore, losses of materials and of dollars and cents through corrosion of industrial equipment seldom become public information.

Large as are these indirect losses, there are also similar losses less readily (Continued)



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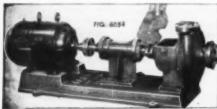
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recognized. For example, appreciable tonnages of metal are consumed needlessly each year because equipment is over-designed to take care of corrosion.

The estimated annual losses are calculated on the basis that all measures which apply to the protection of metals, or which increase the cost of materials over that of steel should be included. Furthermore, labor charges for application or replacement are considered part of the costs.

Herbert H. Uhlig, Massachusetts Insti-tute of Technology, before United Nations Scientific Conference on the Conservation and Utilization of Resources, New York, May 6, 1949.

### CONSERVATION

# . . . Mineral Resources

11. L. Keenlevside

Optimistic observers point out that there is today no serious or general shortage of any essential metallic or non-metallic mineral product. They recall the way in which discovery has kept abreast of increasing demand in the past, and argue that new discoveries, combined with increased effi-ciency in methods of processing and utilization, will be adequate to meet any foreseeable future needs.

Those who take the more pessimistic view rightly emphasize that mineral resources, as contrasted with those of the animal and vegetable kingdoms. are wasting assets. They are not re-

As has already been indicated, and as must be constantly recalled, we are hampered in our consideration of this subject by the fact that there are no reliable and complete statistics covering either the extent of our mineral resources or even the rate at which they are being currently consumed.

If we cannot give an adequate estimate of our present resources we may find some significance in an examination of the certain trend of future

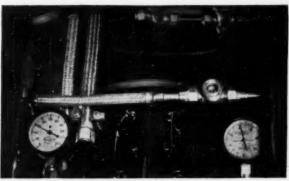
demands.

There are certain basic factors which are clearly distinguishable. The first of these is the rapidity with which the number of human beings on the earth is increasing. Success in the battle against famine and disease is contributing directly to this result. Not only is the population increasing, it is increasing at an accelerating rate.

A second fundamental factor is found in the almost universal demand for a higher standard of living. This will mean, inevitably, an expansion of the demand for mineral products.

Thus it is quite clear that the com-(Continued)

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CONVENTION PAPERS, cont . . .

bination of an increasing population and rising standards of living will place a strain on our metal resources which will almost certainly in the end prove beyond the capacity of man and nature to supply. It remains to be considered what steps can and should be taken in an effort to prepare for this development.

Our hopes for the future should be directed first towards the discovery of

new ore bodies.

It has been said with a great deal of truth that the easy mineral finds have now been made. A review of the discoveries made within the last two decades, particularly in the base metals, reveals only a few of major importance. The lonely prospector with hammer or pan is today a romantic rather than significant figure. In his place the contribution of the scientist must be brought to the rescue of the mining industry.

The greatest hope for fresh supplies of ore depends upon the discovery of new ore bodies in those areas as yet undeveloped. The map of the world shows vast areas of South America. Africa, northern Canada, Asia and Australia, which have not yet been geologically mapped or intensively prospected. New deposits will certainly be difficult to find but with our constantly growing knowledge of the geological and allied sciences it may reasonably be expected that many discoveries will yet be made.

The second step to be taken in our effort to postpone the inevitable date when mineral shortages will develop is the improvement of our techniques of extraction and processing. New and more efficient methods of mining are

constantly being sought.

In the future, as higher grades of ore are depleted, more attention must be given to the treatment of complex and low-grade ore bodies by leaching or other chemical methods. Further study must also be given to the possibility of obtaining minerals from sea water.

In addition to the search for new ore bodies and the improvement of our processes of extraction and treatment, greater study must be given to the possibilities of conservation and

ubstitution.

Under the heading of conservation there are two steps of obvious importance. The first is the re-use of metal scrap. Among the more highly industrialized countries scrap today plays a role of real and increasing importance.

The second step in conservation is the prevention of corrosion by the use

(Continued)

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CAKE IS THEN PLOWED
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YOU'VE CURED OUR BIG-GEST HEADACHE, SAM. CONTINUOUS CENTRIFUG-ING IS NOT ONLY MORE EFFICIENT, BUT I RECOVER MORE SILVER NITRATE AND SAVE THE VALUABLE FLOOR SPACE THOSE OLD SETTLING TANKS TOOK UP. "YOU CAN'T BEAT CENTRIFUGING FOR LOTS OF PRO-CESSES. A.T.E.M., CENTRIFUGALS ARE TAKING OVER MORE AND MORE CHEMICAL JOBS EVERY DAY...AND DOINGEM FASTER, BETTER, AT LESS COST."



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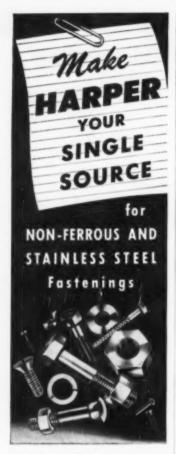
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CHEMICAL ENGINEERING—October 1949

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CONVENTION PAPERS, cont . . .

of preventive coatings of some other metal or of one of the resin compounds, or by the creation of new alloys that resist the corrosive influence of the elements. Much work has already been done in this field but much more remains to be achieved.

Without accepting all of the claims of the chemical fraternity, it is undoubtedly true that over a very wide range of use synthetics can be emploved to relieve the pressure on our mineral-resources. It must, however, be recognized that chemicals, which in turn are based on inorganic materials, are employed in the manufacture of these synthetic products. Thus, indirectly, the drain on the mineral resources of the world will continue even though it may be reduced by the use of synthetics.

The situation that is thus developing will make heavy demands on human intelligence and good will. Since no one nation has been endowed with all its mineral requirements, the problem crosses every national boundary. The discovery of solutions is a matter of universal con-

H. L. Keenleyside, Deputy Minister of Mines and Resources and Commissioner of the Northwest Territories, Ottawa, Canada, before United Nations Scientific Conference on the Conservation and Utili-zation of Resources, New York, Aug. 12, 1846.

# FOREIGN LITERATURE ABSTRACTS

# Spongy Divinyl Polymer

Hydrocarbons of the divinyl series, when stored, have a tendency to form a special type of polymer-a white amorphous mass, insoluble in organic solvents and capable of catalyzing the formation of a product similar to itself in the presence of the original hydrocarbon. This polymer is referred to as the spongy polymer or autopolymer.

This spongy divinyl polymer has been observed to form (1) at a temperature not exceeding 20 deg., (2) during thermopolymerization of divinyl at 40-60 deg., (3) during polymerization of divinyl in the presence of metallic sodium and carbon dioxide. It has been found that the formation of spongy divinyl polymer is accelerated by introducing most of the metals and (Continued)









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FOREIGN ABSTRACTS, cont. . .

certain crystalline substances into the divinyl. Formation of spongy polymer was not observed on metallic lead and copper. Spongy polymer forms on iron at practically any temperature of the polymerization process. It has been proved that spongy polymer does not form when oxygen and peroxide compounds are absent in the divinyl and in the apparatus; formation of the polymer is accelerated by peroxides. Activation of the formation of spongy polymer by iron has an adsorption character; this process of forming polymer on iron can be prevented by creating a monomolecular layer of a polar substance on the surface of the iron.

Digest from "Formation of the Spongy Polymer of Diviny!" by K. B. Piotrovski, Zhurnal Prikladnoi Khimit XXII, No. 5, 518-523, 1949. (Published in Russia.)

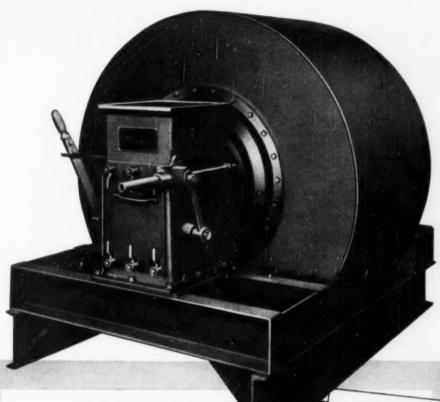
#### Passivation of Iron

Chemo-adsorption lavers of organic compounds have the capacity to passify iron but the effect of such monomolecular lavers is not very great due to their thinness and non-uniform distribution on the surface of the metal. Proteins were selected for study of adsorption passivation since they are readily adsorbed on solid surfaces (especially on metal oxides) and can form multilavers and films. Adsorption of gelatin is at its maximum in an acid medium since the minimum surface tension of a 0.5 percent solution of gelatin is at pH 4-4.5. Hydrolysis of gelatin also increases its "adhering" capacity, which is tied in with proto-lysis of the gelatin. This results in the formation of complicated positive ions which are readily adsorbed on the negatively charged surface of the adsorbent. An acid medium and a negative charge on the surface of the adsorbent are therefore favorable conditions for the adsorption of proteins. Such conditions are provided by mixtures of gelatin and nitric acid. The passivating action of protein adsorption layers is increased by adding phenol and bichromate to the gelatin and nitric acid mixtures. Iron is passivated to solutions of acids by gelatinnitrophenol chemo-adsorption layers. and to both acids and aggressive salt mediums by means of casein-phosphate chemo-adsorption lavers.

Digest from "Adsorption Passivation of Iron by Protein Layers" by G. S. Koshurnikov. Zhurad Prikladnoi Rhimii XXII, No. 7, p. 698-792, 1949. (Published in Russia.)

#### Briefs . . .

Molecular Distillation. This process has made great progress in the last decade, particularly through the de-(Continued)



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Heat increments are controlled by efficiently designed water jackets on rotor and states assembly. Additional water jackets are available completely jacketing the hopper, recirculating line, and outlet valve assembly.

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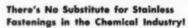
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FOREICN ABSTRACTS cont ...

velopment of new pumps and measuring apparatus. This 8-page article deals with the fundamental physical questions in relation to the degree of separation, thorough mixing in the evaporating layer, evaporation process, instability, and energy efficiency. It is accompanied by graphs, tables, and diagrams of equipment and plants.

From "Molecular Distillation" by R. Jacckel and G. W. Oetlen, Chemie-Ingenieur-Technik 21, No. 9-10, p. 169-176, 1949. (Published in Germany.)

Hydrocyanic Acid. This chemical occurs in coke oven gas as a result of the reaction of part of the ammonia with the incandescent coke. Its content in the gas depends on the coking temperature, height of the oven, water content of the coal charge, and ammonia content. The hydroevanic acid can be separated from the gas (as the article describes in detail) and used as raw material for the preparation of a number of useful products. Graphs, equations, diagrams and flowsheets are given with the descriptions of these reactions

From "Hydrocyanic Acid from Coke Oven Gas as a Useful Coal Product" by W. Klempt, Brensatof-Chemic 30, No. 9-10, p. 148-158, 1949. (Published in Ger-many.)

Mica. Muscovite is the only mica produced on an industrial scale in the Republic of Argentina. The most important deposits occur in the provinces of Catamarca, Cordoba, San Juan and San Luis. A detailed study was made of the physical and mineralogical properties of this mincral and a number of molecular structure diagrams are included in this 4½ page article.

From "Physical-Mineralogical Study of Mica" by G. Jarnheln, Industria Minera VIII, No. 90, p. 20-32, 1949. (Published in Argentina.)

Calcium Gluconate. Electrochemical preparation of this product by oxidation of a solution of glucose to gluconic acid in the presence of calcium bromide and calcium carbonate is one of the surest applications of electrochemical oxidation of organic compounds. The authors review various methods of preparation of this chemical. They come to the conclusion that the Isbell process is the most suitable for industrial application. They give a detailed estimate of a plant with a gluconate output of 5 kg. per 24 hr. The article is written in French.

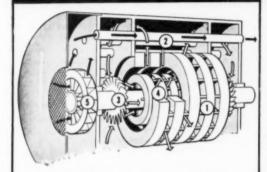
From "Electrochemical Preparation of Calcium Gluconate" by I. A. Atanasiu and G. M. Oprescu, Bulctinul Institutului National de Cercetari Thenologice, 111, No. 3-4, p. 400-412, 1948. (Published in Rumania.)

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CHEMICAL ENGINEERING-October 1949



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INSULATIONS

## Chemical Engineer's Bookshelf

LESTER B. POPE, Assistant Editor

#### Carbon (cont'd) to Cinchophen

ENCYCLOPEDIA OF CHEMICAL TECH-NOLOGY. VOL. III. Edited by Raymond E. Kirk and Donald F. Othmer. Interscience Publishers, New York. 955 pages. \$20.

You'd better hurry and get your copy of Vol. III, Vol. IV is due to be published next month. Incidentally, the whole set is sold on a subscription basis. Sign up for it if you can. There's nothing comparable in the English language. And that means a lot now that the capitals of chemistry and technology have moved from Europe to America.

Now, about Vol. III. The publisher tells us that C was their toughest letter. It breaks across three volumes: II. III and IV. A had more entries, but C is longer. We can believe that when we note that five subjects account for more than half the pages of Vol. III. [They are: carbon (continued from II), cells (electric), cellulose and derivatives, cement and products, chlorine and compounds.]

The book's other half has everything you need from cathartics, chloroform and chocolate up to an including cinchophen (see analgesics). The articles on carbon monoxide and cement are particularly good. The one on carbon (diamond) sounds authoritative, but it is the only one unsigned trade secret, I guess,

No one volume of an encyclopedia is complete. Because of cross-references each new volume adds to the value of those already published. The whole will be greater than the sum of

its parts.-LBP

#### Too Elementary

FUELS AND LUBRICATING OHS FOR INTERNAL COMBUSTION ENGINES. By B. Pugh and J. M. A. Court. Pitman Publishing Co., New York. 169 pages. \$3.50.

Reviewed by Kenneth A. Kobe

This British book deals in an elementary manner with the fuels and lubricants used in internal combustion engines. It was written particularly for "students of aeronautical, automotive and oil engineering and fuel technology, as well as junior members of the staffs of oil companies, the motor-

ing fraternity, and staffs of transport organizations.

All material is elementary from the first chapter on hydrocarbon chemistry written for one who knows little or no chemistry to the final chapter on the meaning and significance of lubricating oil tests, though the integrals and viscosity equations in the latter chapter are incongruous with the general level of the text. The appendix gives both British and U.S. test methods for motor fuels and lubricants. Greases are not included in the book.

The text is so elementary that no chemical engineer or chemist would find the book useful when so many authoritative books exist in this field.

#### Reactions (Cont.)

ENCYCLOPEDIA OF CHEMICAL RE-ACTIONS, Vol. III. Edited by C. A. Jacobson. Reinhold Publishing Corp., New York. 842 pages. \$12.

Reactions of a third section of the elements, taken in alphabetical order, have been collected in the current volume. Elements covered are: cobalt, columbium, copper, didymium, dys-

#### RECENT BOOKS RECEIVED

Acetylene Chemistry. By J. W. Reppe. Charles A. Meyer & Co. \$10.

Advanced Organic Chemistry. G. W. Wheland Wiley. 58.

The Alchemists. By F. S. Taylor. Henry Schuman, \$4,

Chemical Engineering Plant Design. 3rd ed. By F. C. Vilbrandt. McGraw-Hill. 56.

Encyclopedia of Chemical Reactions, Vol. III. By C. A. Jacobson. Reinhold. \$12.

Engineering Developments in the Gaseous Dif-fusion Process. By M. Benedict & C. Wil-liams. McGraw-Hill. \$1.25.

Farmer Victorious. By W. J. Hale. Coward McCann 53.

Freeze Drving. By E. W. Flosdorf. Reinhold.

Industrial Hygiene and Toxicology, Vol. II. By F. A. Patty. \$15.

Physical Methods of Organic Chemistry, Part I. 2nd ed. By A. Weissberger. Interscience.

Scientific Autobiography and Other Papers. By Max Planck. Philosophical Library. \$3.75. Titanium. By J. Barksdale. Ronald Press. \$10. prosium, hafnium, holmium, hydrogen, illinium, indium, iodine and iridium. Reactions of the elements' simpler compounds are included.

Since few reactions can be found in the literature under the rarer elements. holmium and illinium are represented by only one reaction apiece whereas the volume contains 822 reactions for cobalt and 610 for copper.

Arrangement of the entries in this volume is the same as it was in the first two (see Chem. Eng. Feb. 1946, p. 283; July 1948, p. 284).-FA

#### Fruit Processing

CITRUS PRODUCTS, Chemical Composition & Chemical Technology. By J. B. S. Braverman. Interscience Publishers, New York. 424 pages.

Few books have been published exclusively on the chemical composition and chemical technology of citrus products. This is one. For the most part, the author has done a worthwhile informative treatise on a subject he has been associated with for 25 years. Inevitably, there are some personal theories injected throughout the book which to date have not been proved. With these few exceptions only the most recent opinions and structural formulas have been given. The book should prove helpful and informative to food technologists and those engaged in citrus processing.

Section I, given over to chemical composition of the citrus product. sets down what is now known of photosynthesis, properties of the product and the adaptability of these properties. Vitamins present, their importance and methods of detecting them include: (1) Vitamin P. (2) Vitamin A [axcrophthol], (3) Vitamin B, [thiamin, aneurin], (4) Vitamin G [B. (riboflavin or lactoflavin)].

(5) Inositol [C.H.O.] Section II. Chemical Technology, is abundant with clearly defined processes, flowsheets, methods and equipment for fruit processing and extrac-tion of citrus oils. The study further deals with processing citrus juices. concentrated, frozen, sweetened, and fermented juices, miscellaneous citrus products and byproducts. In conclu-(Continued)

291

## TURBO-DRYER OPERATING DATA Two Big Drying Problems Solved!

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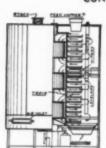
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sion the author sets forth his own theories on future developments which seems feasible in the citrus product industry: (1) Vitamin C from peel effluent, (2) utilization of peel, (3) converting pectin into Vitamin C, (4) drying by sublimation, (5) frozen jellies, (6) high-frequency and infrared dehydration, (7) direct crystallization of citric acid, and (8) sterilization by ultraviolet and ultrasonies.—KH

#### Poisonons

INDUSTRIAL TOXICOLOGY. Lawrence T. Fairhall. Williams & Wilkins Co., Baltimore. 483 pages. \$6.

Reviewed by Morris B. Jacobs

The book is said to have been written in response to many requests for information concerning the toxicity of new as well as old substances of industrial importance. In pursuance of this objective, the author has placed a number of compounds and materials into two large groups. Some 71 in-organic and 134 organic substances and materials or groups of substances are considered in alphabetical order under four principal headings: physical and chemical characteristics, in-dustrial uses, toxicity, analysis. The alphabetical listing has certain advantages and probably greater disadvantages. Thus it seems peculiar to find sulphuric acid listed under hydrogen sulphate and phosgene as carbonylchloride and while the isocompounds are considered with the normal compounds, isophorone is placed as is. Thus one finds the dichloro compounds in the middle of the book and the trichloro and tetrachloro compounds at the end of the book. Carbon dioxide, carbon monoxide, and carbon bisulphide are listed with organic compounds but nickel carbonyl is treated in the inorganic group.

There are serious omissions both as to new and old compounds. Thus one finds gallium, lanthanum, rubidium, cesium, and even plutonium but calcium, sodium, and potassium and their oxides are completely ignored as are the alkalis as a class with the exception of ammonia although any one of these is more important industrially. One also finds DDT, benzene hexachloride, and 2.4-D (relatively non-toxic) but many equally important insecticides and herbicides like nicotine, chlordane, chlorates, and some far more dangerous rodenticides like sodium fluoro-acetate and a-naphthyl thiourea are not even mentioned. Among the inorganic compounds space is given to hydrazoic acid, but

(Continued)



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BOOKSHELF, cont. . .

compounds like calcium cyanamide, nitrogen trichloride, and nitrosyl chloride are omitted. Benzine is passed over without mention.

There are some very serious errors in toxicology. Thus the effect of breathing high concentrations of carbon dioxide is not "specifically that of asphyxia due to the absence of oxygen' (p. 245) for high concentrations of carbon dioxide paralyze the respiratory center. It is not the fact that "exceedingly small amounts of the gas (carbon monoxide) are dangerous" (p. 249). Propvl alcohol is not more toxic than methyl alcohol as appears to be indicated on p. 4. The introduction of hydroxyl groups into "aromatics" does not necessarily increase the toxicity. Actually the increase of OH groups in aliphatic compounds decreases the toxicity.

The author having had excellent libraries available seems to be under the impression that every analytical chemist has such services and that therefore all he need give in his analytical sections are brief notations of methods or references to the literature as common as Lab. Pract (U.S.S.R.) and Khim. Referat. Zhur. (re chloroprene, p. 263.). Dr. Fairhall gives fancy methods for the determination of hydrogen sulphide but the simple detector based on silver evanide which is probably most commonly employed industrially is not listed. The analytical section is wholly inadequate.

There are many other errors; the proofreading is very poor; no medals will be given to the printers for the uneven spacing, cracked and missing letters and high spots; and the publishers cannot be commended for putting out such a poor book.

#### Recent Books & Pamphlets

Critical Requirements for Research Personnel. Published by American Institute for Research, 1617 Cathedral of Learning, University of Pittsburgh, Pittsburgh, Pa. 46 pages. Observations and records of especially effective or ineffective on-the-job behavior made by those in the best position to observe and evaluate scientific personnel.

Moisture Relations in the Manufacture and Use of Cornstalk Insulating Board. Ify O. R. Sweeney and L. K. Arnold. Rulletin 153 published by Iowa Engineering Experiment Station, Aimes, lowa. 36 pages. Gratis. Discussion on capacity of cornstalk Insulating boards for absorbine moisture when containing varied quantities of inflamonation when at different depths of Immension, when a manufacture of wardous bumidities, etc.

Extraction of Suybean Oil by Trichlorocthylene. By O. R. Sweeney, L. K. Arnold and E. G. Hollowell. Rulletin 165 published by Iowa Engineering Experiment Station, Ames. Iowa. 89 pages. Records experience with three successive pilot plant units.

A Brief for Corporation Libraries. By Alma C. Mitchill. Published by Special Libraries Association, 31 East Tenth St. (Continued)



REX SELF-ALIGNING TROUGHING IDLERS automatically align belts without the need for side-guide idlers that impose excessive belt edge wear. They eliminate the misalignments caused by off-center loading, side-wind drifting, warped frames or uneven belt stretch. These idlers fit any belt conveyor frame.

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A Product of MANNING, MAXWELL & MOORE, INC. THAT FORD, CONNECTICU Decicios in the second of the second BOOKSHELF, cont. . New York 3, N. Y. 64 pages. \$1.75. Guide for operation and management.

Cathodic Protection, A Symposium, Published by the National Association of Corrosion Engineers, 905 Southern Standard Bidg., Houston 2, Tex. 202 pages. 38. Review of the state of development of basic principles of cathodic protection and

their application to the control of cor-

Indine Abstracts and Reviews. by Iodine Educational Bureau, Inc., 120 Broadway, New York 5, N. Y. 30 pages. hy louine Educational Dureau, me., I Broadway, New York 5, N. Y. 20 pag Gratia. Vol. I, No. I of a new bi-month periodical to provide summaries of ecitific and technical literature relating the uses of iodine and its compounds.

#### GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering any publications noted in this list always give complete title and the issuing office. Remittance should be made by postal money order, coupons, or check. Do not send postage stamps, All publications are in paper cover unless otherwise specified. When no price is indicated, the pamphlet is free and should be ordered from the bureau responsible for its issue

Hayon. "Rayon Prices: Past, Present, and Future." By Robert B. Evans. Bureau of Agricultural and Industrial Chemistry. ARC-235. April 1949. Mimeographed. Elaborate statistical summary of the factors which affect use and cause higher cost and prices, with rather definite fore-

Fertilizers. "Influence of Fertilizers on Growth Raies, Fruiting Habits, and Fiber Character of Cotton." By D. R. Hooton, et al. Department of Agriculture, Tech-nical Julielin No. 979. Price 10 cents.

Termites. "Preventing Damage to Build-ing by Subterranean Termites and Their Control." Department of Agriculture, Farmers Bulletin No. 1911. Price 15 cents. Drafted largely in popular language for home users but equally adaptable for industrial instruction.

Foreign Products Committee." Interim Report on the European Recovery Pro-gramme. Organization for European Co-Operation. Available from

Catalog on Laboratory Furniture and Equipment.

Publications Section, Economic Coopera-tion Administration, Washington, D. C. Includes summary of estimates from co-operating nations regarding nitrogenous fertilizers, rock phosphate, soluble phos-phates, potash, sulphur, dyeatuffs, and plastic raw materials. Includes forecasts under present programs with estimates for the fiscal year 19-2-19-53.

Trees. "Trees." Agricultural Yearbook. Price \$2. Emphasizes importance of forests to our national and individual prosperity, security, and happiness.

Air Force, "A Guide For Selling to the United States Air Force," Department of the Air Force, 1949. Price 15 cents. An outline of Air Force organization for pro-curement and identification of regional and general purchasing offices.

Optics. "Research and Development is Applied Optics and Optical Glass at the National Bureau of Standards." By L. C. Gardner and C. H. Hahner. National

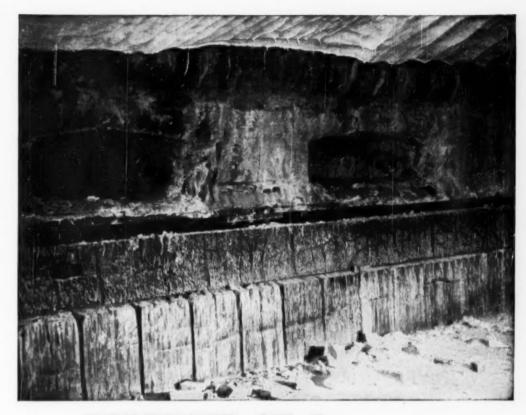
(Continued)



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The photograph above shows the first two ports in the melting end of a plate glass furnace after 1290 days and 207,236 tons of glass. (The sidewalls were Corhart Standard blocks — 12" thick in the lower course, and 8" thick in the top course.)

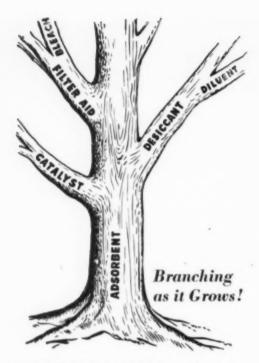
But look at that superstructure, built with Corhart Standard Electrocast jambs, plates, crown skew and crown first course. The superstructure took quite a beating in this area, as the 8 remaining inches of the 18" silica crown plainly shows. Not much is left of the plates, but they did survive the campaign without patching, and the jambs, arches, crown skews and first-course crown blocks are still in excellent shape. To fortify this area for the next campaign, the operator has installed Corhart Zac refractories in these top course walls and in this entire superstructure area.

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GOVT. PUBS., cont. . .

Bureau of Standards, Miscellaneous Pub-lication 194. Price 15 cents. Principally discusses uses of optical glass. Does not describe large-scale manufacturing equip-ment which has been elsewhere reported. Includes elaborate bibliography.

Armed Services. "Armed Services Pro-curement Regulation." Section VII—Con-tract Clauses and Forms. Price 10 cents, Separate from Armed Services Procure-ment Regulations. Gives contract clauses and forms available for use in all pur-chases of the national military establish. Seles managers of industrial firms regulated as to applicable forms of agree-ment regarding fixed-price contracts.

Bose Char. "Proceedings of the Technical Session on Bone Char, 1949. National Bureau of Standards." Price S2. Avail-able from J. M. Brown, Secretary-Treas-urer, Bone Char Research Projects, Inc. c/o Revere Sugar Refinery, 323 Medford Street, Charleston 29, Massachusetts. A resum of extended research conference among supporters of the bureau program.

Research Projects. "Survey of University, Business, and Economic Research Projects, 1947-1948." By Lyle C Bryan. Small Business Division, Department of the Business Includes the Comparator of the Price 41. Includes descriptive paragraph about each of nearly 1,290 research projects, a considerable number of which deal with manufacturing and process industry problems. No results are given, merely a description of the scope of surveys or research projects outside government.

Inserticides. "A Photographic Method for Recording Size of Spray Drops." By J. M. Davis. Bureau of Entomology and Plant Quarantine, ET-272.

Wastes. "A Selected Bibliography of Periodical Literature on Fruit and Vege-table Processing Wastes." By O. R. Vasak and W. L. Shaw. Bureau of Agri-cultural and Industrial Chemistry. AIC-232. Mimeographed.

Business Indexes, "Economic Indicators," A monthly printing of charts and data prepared by the President's Council of Economic Advisors and published by Congressional authority for industrial use. Available by subscription only. Price \$1.75 per year. Most of the data report indexes of business activity believed to be General, not specifically related to the industry.

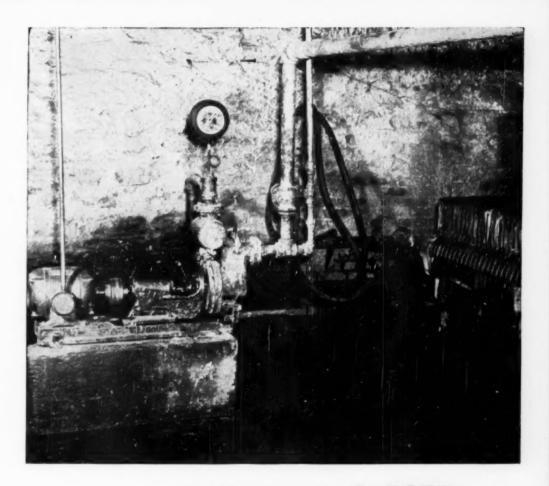
Safety, "Injuries and Accident Causes in Fertilizer Manufacturing, Bureau of Labor Statistics," Bulletin No. 949. Price 29 cents. A detailed analysis of hazards and injury-frequency rates in 1946 by region, plant-size, and department.

Production Survey. "The Concentration of Productive Facilities, 1947." Report of the Federal Trade Commission. Total Manufacturing and 25 Selected Industries, 1976: 25 cents. Gives for several process industry groups information regarding the play in the total national production.

European Economics. "Economic Survey of Europe in 1948." Prepared by Research and Planning division of the Economic Commission for Europe. United Nations Economic and Social Council. Price \$1. Gives considerable detail as to European conditions; not up-to-date, but still sig-nificant with reference to basic business problems.

problems.

Natural Gas. "Natural Gas Investigation (Docket No. G-580)." Federal Power Commission. Report of Commissioners Nelson Lee Smith and Harrington Wimberly. Price \$1.50. Report of Commissioners Leiand Olis and Claude L. Draper. Price \$6 cents. Two documents, summary as a result of the ports of commissioners inquiry carried out during a long perfod ending in 1948. The opinion written by Commissioners Smith and Wimberly includes elaborate statistical summaries, maps, diagrams, and a discussion of products recovered from or made from natural gas as a raw material. The report of Commissioners Olds and Draper gives little new data but presents an entirely different philosophy of federal regulation and recommended national policy.—End



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#### MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterheads.

Filters. Titeflex, Inc., 523 Frelinghuysen Ave., Newark 5, N. J.—12-page booklet describes filters featuring a backwashing system to aid cleaning. Includes details of construction, drawings illustrating op-eration, and data on stone membrane and wire mesh membrane.

Resins, Hercules Powder Co., Wilmington, Del.—29-page hooklet contains a property chart and description for each synthetic resin made by this company. Includes a full 2-page table showing the degree to which the resins are used in various in-dustries.

Process Equipment. Hardinge Co., 240
Arch St., York, Pu.—32-page Bulletin 16-D
deals with rotary dryers, kilns, and coolers. Discusses and fully illustrates the
basic principles behind the construction
of the various pieces of equipment, fucludes over-all dimensions of all models
as well as typical flowsheets showing how
various, rotary units are used in continuous flow operations.

Pumps. Allis-Chalmers Mfg. Co. 1147A South 76th St. Milwaukee, Wis.—24-page Bulletin 68B5145A describes a line of single stage, double saction pumps. In-cludes tables of available sizes, approxi-mate dimension and head capacities.

Chemicals. Allied Chemical & Dye Corp., General Chemical Division, 40 Rector St., New York 6, N. V.—175-page book No. 8915 covers industrial chemicals made by this company. For each chemical is given physical properties, grades or strengths available, packing, shipping regulations

and principal uses. A brief history of the development of each chemical is given along with photographs showing appli-

Caustir Soda. Allied Chemical & Dye Corp., Solvay Sales Division, 46 Rector St., New York 6, N. Y.—80-page Bulle-tin No. 6, properties and handling of caustic soda. Fully illustrated.

Wire Cloth. Ludiow-Saylor Wire Co., 632 South Newstead Ave., 8t. Louis 10, Mo. – 31-page booklet—types of wire cloth and acresns, production, uses.

Solvents. Allied Chemical & Dye Corp., Barrett Division, 40 Rector St., New York 6, N. Y.—36-page booklet describes with diagrams and pictures the properties and uses of Allied's aromatic industrial

Metal Meah. C. O. Jelliff Mfg. Corp., Southport, Conn.—8-page booklet describ-ing a metri screen formed by electro-deposition of pure copper, pure nickel, or a combination of the two metals.

Filters. Elmeo Corp., 51-52 South St., New York, N. Y.—S-page Bulletin F-2009 covers the continuous vacuum cane mud filters made by this company. Contains flow charts and diagrams showing the filter in use.

Gage Accessory. Jerguson Gage & Valve Co., 80 Fellsway, Somerville 45, Mass.— 2-page flyer, Unit No. 117, illustrates and (Continued)

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P-20

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In installations in many industries where corrosive fumes, vapors, dusts, and gases are encountered, Transite Industrial Vent Pipe is yearly demonstrating the fact that it

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ant... needs no painting... resists corrosion outside, inside and all the way through. For full details about Transite Industrial Vent Pipe, write Johns-Manville, Box 290, New York 16, N.Y.

Mers.' Pubs., cont . . .

describes the use of an explosion proof gage illuminator.

Baffle. Henry Vogt Machine Co., 1000 West Ormsby St., Louisville 10, Ky.— 4-page leaflet describes n baffle for tightly sealing two shell-pass heat exchangers.

Motors. U. S. Electrical Motors Inc., 206 East Slauson Ave., Los Angeles 54, Calif.— 5-page Bulletin No. 1524 describes line of horizontal motors. 1<sub>5</sub> to 250 hp. and feature asbeston-protected windings.

Precess Equipment, Bauer Bros. Co., 1726 Sheridan Ave., Springfield, Ohio.—S-page Bulletin 50 illustrates and describes such equipment as pulp refiners and paper stock classifiers, attrition and hammer mills, magnetic separators, etc.

Filter Cloth, John A. Roebling's Sons Co., Trenton 2, N. J.—4-pages, gives data on resistance to chemical corrosion of filter civilin made of Hastelius H and C.

Chemicals. Monsanto Chemical Co., Phosphate Division, St. Louis 4, Mo.—Two S-page booklets describe the properties and function of two complex sodium phosphates. Bulletin No. P-135 cover sodium thought to Bulletin No. P-24 covers to a complex sodium pyrophosphate anhydrous.

Equipment. H. W. North Co., 1213 Parade St., Erie, Pa.—Data Sheet No. 306-275 describes the line of mixing and blending equipment.

Agitators. Industrial Process Engineers, 8 Lister Ave., Newark 5, N. J.—4-page Builetin, No. 482 describes construction features, design and applications of this company's line of side-entering agitators.

Gas Absorbers. Patterson Foundry & Machine Co., East Liverpool, Ohlo.—5-page paper "Agitated Gas Absorbers" discusses the processes for which gas absorption apparatus of the mechanical agitator type are best suited.

Bark Products. Weyerhaeuser Timber Co., Silvacon Products Dept., Longview, Wash.—4-page Bulletin 10 lists principal uses of fractionated bark products. Contains tables of physical and chemical properties of cork, fibers and powders.

Pumps. Allis-Chalmers Mfg. Co., 1147 South 76th St., Milwaukee, Wis.—16-page Bulletin 68X6256A gives the how and why of centrifugal pump construction and their effect on pump maintenance. Tells how to figure heat; carries tables to help determine total rfiction loss.

Motors. Telechron Inc., Ashland, Mass— S-page leaflet gives dimensions, mounting plans and performance ratings for this company's line of synchronous motors. Includes cutaway view showing construction features.

Gear Speed Reducers. D. O. James Gear Mfg. Co., 1140 West Monroe St., Chicago 7, III.—82-page price list and selection table of this company's motorized gear speed reducers. There is also a 16-page price list covering gear speed reducers and flexible couplings.

Equipment. Sprout, Waldron & Co., Inc., 17 Sherman St., Muncy, Pa.—12-page Bulletin 44 illustrates and describes equipment for size reduction, mixing and blending, bulk materials handling, product classitication, pelleting and special facilities.

Solvents. Celanese Corp. of America. Chemical Division, 180 Madison Ave. New York 16, N. Y.—4-page leaflet listing this company's colvents, their properties and specifications.

Air Filter, Industrol Corp., 88-35 76th Ave., Glendale, Brooklyn 27, N. Y.—1-page flyer lists capacities, dimensions and prices for this company's line of air filters.

Motor Starter. Trumbull Electric Mfg. Co., Plainville, Con.,—4-page Circular TEC-3174 describes a manual starter to protect small motors up to 1 hp. from overload. 4-page Circular TEC-151 covers a flexible system for the distribution of light and poweg.

Silicone Greams. Dow Corning Corp., Midland, Mich.—4-page leaflet No. D-5 describes the properties and performance of (Continued)

Johns-Manville
TRANSITE Industrial PIPE



Toothed Lack Washer: Prevents loss of stem nut due to vibration, thereby holding the handwheel securely.



Newly Designed Handwheel: Aircooled, finger grip handwheel affords sure grip even with greasy gloves.



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BERSWORTH CHEMICAL COMPANY Framingham, Massachusetts MFRS.' Pubs., cont . . .

scribes the properties and performance of silicone lubricants. Another 4-page leaflet No. D-6 contains recommendations on the use of silicone grease in the bearings of electric motors.

Materials Handling, Richardson Scale Co., Clifton, N. J.—Bulletin No. 0649 describes an oscillating packer for bagging chemicals, feeds, meals etc. A second builetin, No. 1349, describes a coal spott for stoker firing. Bulletins 1549 and 1449 describe two Cybes of automatic bulk weighing

Glass Equipment, Corning Glass Works, Corning, N. Y.—S-page Bulletin EB-1 contains photographs and descriptions of plant equipment glassware for the process industries.

Magnetic Equipment, Eriez Mfg. Co., 870 East 12th St., Erie, Pa.—12-page Catalog No. 14 describes a line of permanent nonelectric magnetic separators and electronic metal detectors.

Cooling Towers. Marley Co., Fairfax and Marley Rds., Kansas City 15, Kans.— 4-page leaflet contains 10 questions and answers on cooling tower specifications.

Blowers. Lamson Corp., Allen Billmyre Division, Syracuse 1, N. Y.—4-page Bulletin B-5-4 illustrates and describes the design and operation of the blowers and exhausters made by this company.

Motors, Link-Belt Co., 367 North Michigan Ave., Chicago I, III.—12-page Book No. 1815A Illustrates and describes the gearmotors made by this company. Includes dimensional data and drawings.

Instruments. Builders-Providence, Inc., Providence I. R. I.—4-page Bulletin \$40-Fed describes an instrument to meter chlorine gas and to produce and deliver a rhiorine-water solution to the point of application.

Gingra. W. C. Dillon & Co., 5410 West Harrison St., Chicago 44, III.—4-page leaflet illustrates applications of pressure gage. Includes prices, engineering data and dimensions.

Power Control. Taller and Cooper Inc., 55 Front St., Brooklyn I, N. Y.—11-page Catalog PL-100 covers special power control equipment such as panel boards, gage locards, switchbagrds and control consoles.

Alloy Steel. Joseph T. Ryerson & Son, Rox 2000-A. Chicago <sup>80</sup>, III.—24-page booklet contains pointers on the selection of alloy steels.

Safety. Bristol Co., Waterbury 91, Conn.—Bulletin No. W1816 describes a combustion safeguard and explains its application in protecting gas-fired ovens, furnaces, kilns, boilers, etc.

Metal Hose. Atlantic Metal Hose Co., 123 West 64th St., New York 2, N. Y.—Catalog 166 covers recent developments in interlocking and seamless hose as a flexible medium for such applications as diesel exhausts, conveying liquids, gazes, solide and semi-solids; and in beat and pressure

Hydraulic Cylinders. Ledeen Mfg. Co., 1600 South San Pedro St., Los Angeles 15. Calif.—2 page Builetin CS 649 describes the use of hydraulic cylinders for controlling large gate valves in paper mills or chemical plants.

Glass. Corning Glass Works. Corning. N. Y.—14-page Bulletin B-53 entitled "Froperties of Selected Commercial Glasses" contains data on properties and "Second Bulletin B-54 is entitled "Manufacture and Design of Commercial Glassware."

Welding, Wall Colmonoy Corp., 19345 John R St., Detroit 2, Mich.—4 page leaflet discusses and illustrates a powder metallizing gun and its use.

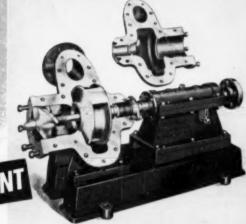
Protective Contings. United Chromium Inc., 51 East 42nd St., New York 17, N. Y.—4-page leaflet gives information on four groups of contings developed for corrosion control, chemical resistance and heavy duty industrial painting.

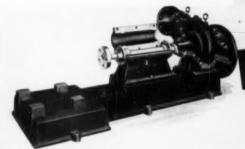
Castings. Cooper Alloy Foundry Co., Hillside 5, N. J.—4-page bulletin on corrosion (Continued)

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resistance of stainless, Monel and nickel castings.

Belting. United States Rubber Co., Rockefeller Center, New York 20, N. Y.—28page catalog gives design, engineering and performance data for this company's line of transmission belting.

Pumps. F. J. Stokes Machine Co., 5800 Tabor Rd., Philadelphia 20, Pa.—36-page booklet describes a line of high vacuum pumps. Includes specifications and applications.

Adhesives. Paisley Products, Inc., 1770 Canalport Ave., Chicago 16, Ill.—6-page folder discusses and Illustrates the uses for adhesive products.

Heavy Chemical Plants. Nicolay Titlestad Corp., 11 West 42nd St., New York 18, N. Y.—Builetin covers typical heavy chemical piants constructed here and abroad, Contains illustrations and photographs of plants from 10 to 100 tons.

Gas Appliance Accessories. Rockwell Mfg. Co., Pittsburgh Equitable Meter Division, Pittsburgh 8, Pa.—Bulletin 1036 describes a line of gas appliance regulators and allied equipment.

Instruments. Brookfield Engineering Laboratories, Inc., 002 Porter St., Stoughton, Mass.—8-page catalog describes the viscosity measuring device made by this company.

Safety. E. D. Bullard Co., 275 Eighth St., San Francisco 3, Calif.—Catalog covers personal protective equipment and industrial safety devices.

Value Lubricant. Bookwell Mis. Co., Nordstrom Valve Division, Pitraburgh S., Pa.—4-page booklet gives information and data on this company's line of lubricants for automatic plug valves.

Flow Regulators. Conoflow Corp., 2160 Arch St., Philadelphia 3, Pa.—6-page Bulletin No. 103 illustrates and describes the line of flow control devices made by this company.

Expansion Joints. Chicago Metal Hose Corp., Maywood, III.—25-page catalog contains construction and installation data on corrugated expansion joints.

Process Equipment, Worthington Pump and Machinery Corp., Harrison, N. J.—2-page Bulletin C-1106-874 gives specifications dimensions, and physical data on ammonia product coolers. 2-page Bulletin C-1106-873 covers package air conditioners. Bulletin W-395-B1, 4 pages, contains photographs and data on self-priming centrifugal pumps.

Materials Handling Equipment. Hewitt-Robins Inc., Robins Conveyors Division, 279 Passaic Ave., Passaic, N. J.—4-page Bulletin No. 130 describes and illustrates the working of a light-weight car shakeout.

Instruments. Bristol Co., Waterbury, Conn.—32-page Bulletin A120 describes a line of air-operated controllers for temperature, pressure, flow, liquid-level, humidity and pH value.

Cement. Cellcote Co., Rockefeller Bldg., Cleveland, Ohio—2-page flyer gives the properties and directions for use of a resin cement.

Models. Visual Planning Equipment Co., Pennsylvania Ave. at River, Oakmont, Allegheny County, Pa.—32-page catalog lists models available from this company.

Pumps. De Leval Steam Turbine Co., Trenton 2, N. J.—12-page Catalog 1550 illustrates and describes opposed impeller pumps. Charts show motor and pump sizes. Diagrammatic drawings illustrate dimensions.

Bust Filter, Day Co., \$10 Third Ave. Northeast, Minneapolis 13. Minn.—3-page Bulletin 49.1 illustrates and describes dust filters. Includes schematic drawing showing operating principle and charts giving capacities and dimensions.

Safety. Factory Mutual Engineering Division. 184 High St., Boston 10, Mass.—2-page Bulletin No. 280 discusses fire-safety during plant shut-downs. Lists during plant shut-downs. Lists.

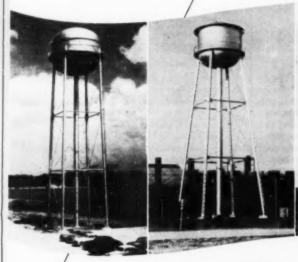
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items requiring attention before a plant

Chemical Cleaners. Sumeo Porducts, Inc., 144 Centre St., Brooklyn, N. Y.—Brochure covers chemical cleaning of boilers, feed water heaters, condensers, evaporators, heat exchangers, piping, etc. Describes solvents employed, control methods, and procedures. procedures.

Rotameter. Brooks Rotameter Co., P. O. Box No. B-2549, Lansdale, Pa.—4-page Builetin 6 describes the line of rotameters with safety shielding made by this com-

Instruments. Foxboro Co., Foxboro, Mass.

—32-page Bulletin 427 presents a line of instruments for process measurement and control. Explains the principle of operation, gives detail on construction. 15-page Bulletin 430 describes equipment for measurement and control of pH industrial processing operations.

Instruments. Builders-Providence, Inc., Providence I. R. I.—16-page Bulletin 400-F1 describes flow meters made by this company. Illustrated in detail.

Instruments. Fischer & Porter Co., Hat-boro, Pa.—24-page Catalog 5a covers in-struments for remote indicating, control-ling and totalizing, 4-page Catalog Section 96 deals with a flow rate indicator for coolants, lubricants, opaque liquids and sturries. Catalog Section 97 lists recom-mended materials of construction for flow rate instruments.

Motors. Howell Electric Motors Co., Howell, Mich.—4-page Bulletin SR-1 illustrates and describes wound rotor machines. Includes performance curve and chart giv-

Dust Control. American Wheelabrator & Equipment Corp., 555 South Byrkit St., Mishawaka, Ind.—Report on a method of overcoming the dust nuisance created in the handling and mixing of dry pigments used in the manufacture of paint.

Process Equipment. Denver Equipment Co., P. O. Box 5288, Denver 17, Colo.— 2-page Bulletin C12-Bi flustrates and describes portable crushing units. Two 4-page bulletins. Nos. G-4907-N and G-4997, catalog various types of equip-ment this company has in stock for quick delivery.

Gage, Vapor Recovery Systems Co., P. O. Box 231, Compton, Calif.—3-page booklet discusses the construction and use of an electronic liquid level gage.

Cleaners. DuBois Co., Industrial Division, Cincinnati 3. Ohio.—Portfolio on steam cleaning discusses applications and main-tenance. Another booklet provides cost figures on emulsion cleaning.

Instruments. Rockwell Mfg. Co., Pitts-burgh Equitable Meter Division, Pitts-burgh 8, Pa.—Bulletin 1044 describes a line of pressure regulators giving con-struction and application details. Contains typical performance curves.

Gages. Williams & Hussey Machine Co., Star Brass Mfg. Co. Division, Wilton, N. H.—t-page leaflet describes types, ranges, and construction details of rhis company's line of gages. Another learlet describes a gage tester.

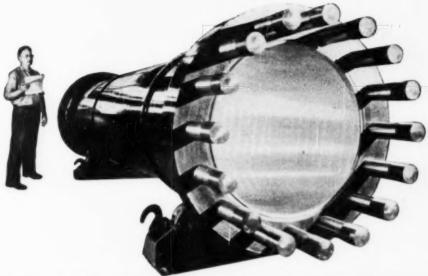
Instruments. Proportioneers, Inc., 9 Cod-ding St., Providence I, R. I.—8-page File 1709A.21 describes and illustrates the working of this company's instrument for diluting caustic.

Materials Handling, Lewis-Shepard Products Inc., 267 Wainut St., Watertown 72, Masse.—Bulletin 24 covers Jackiff electric trucks for horizontal movement and JackStackers for both horizontal and vertage of material on skids and single or double faced pallets.

Gages. Bristol Co., Waterbury 91, Conn.

Builetin G620 describes a gage for recording and controlling absolute pressure
within a scale range as low as zero to within a scale 20 mm, Hg abs

Conveyors. Hapman Conveyors, Inc., 2405-13 West McNichols Rd., Detroit 21, Mich.—40-page Catalog No. 5000 covers pipe conveyors and accessories.



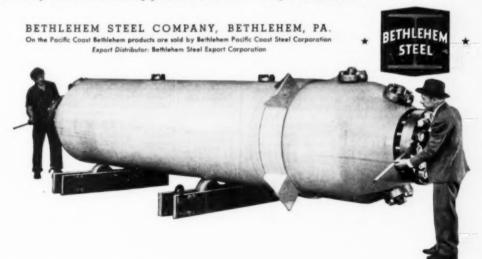
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### to your specifications

Bethlehem is exceptionally well equipped for the building of seamless forged pressure vessels in all required sizes and types. Both carbon and alloy steels are available at Bethlehem for this purpose, and a wide range of forging, treating, and machining equipment makes possible a fully-rounded service.

A Bethlehem-built vessel is one you can rely upon. Each step in the manufacturing process is handled by men of long experience, and no vessel leaves our plant until it has undergone exhaustive tests and inspection.

Whether you are planning one unit or many, let us work with you. An order placed with Bethlehem is in competent hands, and the finished job will meet your specifications in every detail. Call or write for complete information.





. While CITRIC ACID is one of the most widely used food acids in the pharmaceutical, food and beverage industries, modern chemical research continues to develop new and varied uses for this versatile acid and its derivatives.

CITRIC ACID contains a total of four reactive groups. With these readily substituted radicals, just consider the large number of related but chemically different compounds that can be synthesized!

Esterify the carboxyl groups of CITRIC ACID with one or more alcohols and you obtain a group of valuable plasticizers that are basic raw material for the fabrication of synthetic plastica.

React CITRIC ACID with a variety of bases and you can make normal or acid salts now being widely employed to condition water, and to clean and polish metals.

Subtract a molecule of water or carbon dioxide from CITRIC ACID and you get unsaturated dibasic or tribasic acids which on hydrogenation form new compounds extremely resistant to oxidation.

#### THE SALTS AND ESTERS OF CITRIC ACID

shown in the table to the right are all produced by Pfizer. The uses listed may suggest other applications worthy of your investigation.

PFIZER CITRIC ACID is available as the hydrate or U.S.P. preparation and as ANHYDROUS CITRIC ACID. The latter chemical is identical in purity to CITRIC ACID U.S.P. but contains no water of crystallization. For the latest technical information on this versatile chemical building-block write today to our Technical Service Department. Chas. Pfizer & Co., Inc.; 630 Flushing Avenue, Brooklyn 6, N. Y.; 425 N. Michigan Ave., Chicago 11, Illinois; 605 Third Street, San Francisco 7, California.

#### NEW FIELDS OF USE FOR CITRIC ACID AND ITS DERIVATIVES

|  | FIELD                                | USE  |
|--|--------------------------------------|--|
| Citric Acid  | Cleaning and<br>Plating of<br>Metals | Electrolytic polishing of stainless steel.   |
| Ammonium<br>Citrate Dibasic  | Cleaning and<br>Plating of<br>Metals | Removes rust and scale.  |
| Sodium Citrate   | Water<br>Conditioning                | Sequesters metallic contaminants.  |
| Calcium Citrate  | Construction                         | Slaws the setting of cement and plaster.   |
| Triethyl Citrate<br>Tributyl Citrate<br>Acetyl Triethyl<br>Citrate<br>Acetyl Tributyl<br>Citrate | Plastics<br>Industry                 | Plasticizers for a wide<br>variety of synthetic<br>plastics.   |
| Itaconic Acid<br>(Citric Acid less<br>CO <sub>2</sub> +H <sub>2</sub> O)                         | Paint and<br>Varnish<br>Industry     | Shortens reaction time<br>gives harder finishes,<br>improves calar, shortens<br>baking time of ail<br>modified alkyds. |
| Itoconic Acid  | Plastics<br>Industry                 | Condensed with glycolor simply esterified, may<br>be polymerized to form<br>clear hard plastics.                       |
| Acomitic Acid<br>(Citric Acid loss<br>H <sub>2</sub> O)  | Plastics<br>Industry                 | For preparation of<br>synthetic resins and<br>plasticizers.  |
| Tributyl Citrate   | Textile                              | Anti-fooming ogent.  |



## Chemical Economics

RICHARD F. WARREN, Assistant Editor

#### Labor Strife and Possible Declining Export Prices Create Concern in Process Industries

Late in September the great enigma in the chemical consuming industries was the final effect of the devaluation of the pound on world consumption of our chemicals and other products of the process industries. Many trade experts seem to feel that Britain will not cut the export price of any item unless it is in direct competition with a non-sterling product. As a result, process industries were following the general policy of "wait and see." However, most executives seem to feel that there will be no general effect on prices.

Major effect of the current labor strife will be felt in the steel, iron, and related coal chemicals industries. Most consumers have been building up stocks of these products in recent months to prepare for the threatening

steel strike.

Late in the summer the consumption of chemicals in the rayon industry picked up as consumption in this branch of the process industries climbed to a new high for the year in August. Deliveries rose to 88 million pounds while rayon stocks dropped 10.5 million pounds in the same month. Exports of rayon will set new records, according to the Rayon Organon, if the first half rate continues for the rest of the year. Other fibers heading for new highs in exports include nylon yarn. In the first six

months of 1949 more than I million pounds were exported. This is still only a small fraction of the total nylon yarn produced. In 1948 an estimated 52 million pounds of nylon were produced. Late in September the iron and steel industry had climbed back to 86 percent of capacity in their operations.

Consumption of chemicals in the petroleum industry was up in August compared with July. However, it is still considerably below the 1948 rate. Researchwise, however, the petroleum industry is investing almost four times as much as it did ten years ago. This is being done to diversify its products. More than \$100 million is being spent on research in this industry at the present time according to Dr. Wayne E. Kuhn, manager of Texas Co.'s technical and research division.

Speaking at the ACS meeting in Atlantic City, Linus Pauling, president of the society, urged that both a government sponsored National Science Foundation be established to aid research and that in addition private industry establish a Research Foundation to provide \$75 million a year for basic research by 1957. According to government estimates, industrial firms spent \$450 million on research in 1947 and by 1957 research expenditures by industry may reach \$750 million. Prof.

Pauling stated that such expenditures if used to promote work in the private colleges and universities and would "avert the dangers of bureaucratic domination."

A bright future for a strong and vital chemical processing segment of American industry is in prospect if these plans are pushed on to fruition.

With production running 8 percent ahead of 1948, the American potash industry is heading for new output records in 1949. Development of additional New Mexican deposits is being explored by several firms including Duval Texas Sulphur Co.

#### Price Trends

Although there has been some price weakening in limited areas—such as the recent lead pigment cut—the chemical price index shows a definite leveling off in recent months. However, oil and fat prices continued to drop during September. Chemical Engineering's oil and fat index fell to 144.67 by October 1.

A reversal in buying habits has been taking place in recent weeks. During the summer many chemical firms were operating on a hand-to-mouth to 50-day inventory wherever practical. Now many firms have switched to a 60-day policy. According to the National Association of Purchasing Agents, 98.8 percent of their reporting firms are maintaining a "90 day or less" inventory rule. This policy has been bypassed in the cases where interruption of supplies seems threatened.

A lack of demand has brought a new drop in lead and zine prices. Among the effects of this dip were cuts in the prices of lead and zine pigments. Lead acetate fell 2½c. per lb. and at least one producer cut the white lead price.

Drops in consuming markets have brought on a price adjustment for soda ash by major producers. One producer put out a price schedule eliminating the less than 300 ton carload rate. This made Solvay and others "meet the competition" and their current price in bulk carloads is \$1 per 100 lb. for light ash, and \$1.10 per 100 lb. for dense ash. Carloads in bags are 25c. per 100 lb. higher.

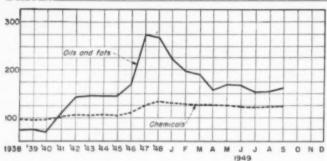
#### Regional Distribution of Certain Chemical Process Industries

|                          |              |            |                          |                          | 2 10000                  | ************             |                    |                   |                |
|--------------------------|--------------|------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------|-------------------|----------------|
|                          |              |            | P                        | ercent of T              | S. total)                |                          |                    |                   |                |
|                          | Pacific      | Mountain   | West<br>North<br>Central | West<br>South<br>Central | East<br>North<br>Central | East<br>South<br>Central | Middle<br>Atlantic | South<br>Atlantic | New<br>England |
| Chemicals                | & Allies     | d Products |                          |                          |                          |                          |                    |                   |                |
| 1947                     | 5.7          | 0.7        | 6.1                      | 7.2                      | 25.5                     | 5.4                      | 39.8<br>36.2       | 14.6              | 4.0            |
| Petroleum                | & Coul       | Products   |                          |                          |                          |                          |                    |                   |                |
| 1947                     | 10.8<br>12.8 | 2.5        | 3.9                      | 28.4                     | 21.5                     | 3.0                      | 25.8<br>27.5       | 2.4               | 1.7            |
| Paper & A                | Ilied Pro    | ducts      |                          |                          |                          |                          |                    |                   |                |
| 1947                     | 8.9          |            | 4.3                      | 3.5                      | 27.0                     | 2.3                      | 25.5<br>27.7       | 9.1               | 13.8           |
| Leather &                | Leather      | Products   |                          |                          |                          |                          |                    |                   |                |
| 1947<br>1939             | 1.0          | 0.3        | 10.4                     | 0.7                      | 21 .5<br>23 .5           | 3.4                      | 30.6               | 4.8               | 28.2           |
| Rubber Pr                | oducts       |            |                          |                          |                          |                          |                    |                   |                |
| 1947<br>1929<br>Textiles | B.s.         | n.a.       | 2 23                     | B.S.                     | 44.2<br>52.5             | Billi<br>Billi           | 16 2<br>16 6       | n.n.<br>n.n.      | 16.7<br>15.4   |
| 1947                     | 0.9          |            | 0.5                      | 0.8                      | 3.7                      | 6.9                      | 25.6               | 38.2              | 23 3           |
| 1939                     | 1.2          |            | 0.8                      | 0.9                      | 4_9                      | 5.5                      | 31.2               | 29 9              | 25.5           |
| Glass, Clay              | & Slop       |            | 42 4                     |                          | (90) 40                  | 2.0                      | 1000 00            |                   |                |
| 1939                     | 7 8<br>6 4   | 1 4        | 8.7                      | 4.7                      | 29.8<br>30.0             | 3 9                      | 29 .8<br>26 .5     | 10.5              | 4.8            |

n.a.—not available. Fource: 1947 Census of Manufacturers—value added to product.

#### PRICE. CONSUMPTION AND PRODUCTION TRENDS

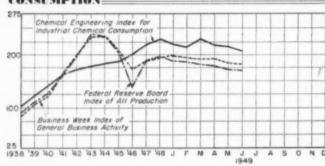




Chemical Engineering's Price Index A month, a year, and two years ago

|                  | Chemicals | Olls & Fat |
|------------------|-----------|------------|
| As of October 1. | 123.02    | 144.67     |
| Last month       | . 123.23  | 161.08     |
| October 1948     | 132.80    | 249,27     |
| October 1947     | 124.94    | 251.70     |

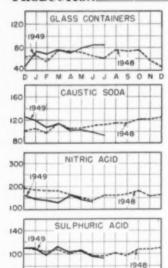
#### CONSUMPTION=



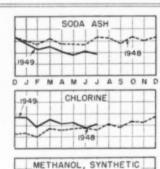
Chemical Engineering's Consumption Index for Industrial Chemicals (A breakdown by consuming industries)

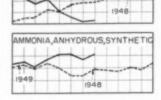
|                    | June   | July   |
|--------------------|--------|--------|
| Fortilizers        | 48.50  | 49.91  |
| Pulp and paper     | 20.35  | 17.80  |
| Petroleum refining | 20.18  | 22.11  |
| Glass              | 19.15  | 19.38  |
| Paint and varnish  | 24.45  | 20,42  |
| Iron and steel     | 11.90  | 10.61  |
| Rayon              | 19.22  | 20.02  |
| Textiles           | 8.41   | 6.96   |
| Coal products      | 10.10  | 9.56   |
| Leather            | 4.17   | 3.73   |
| Explosives         | 7.41   | 8.19   |
| Rubber             | 4.86   | 4,06   |
| Plastics           | 8.07   | 7.26   |
| INDEX              | 206.77 | 200.01 |
| =                  | 1925   | = 100  |

#### PRODUCTION ....

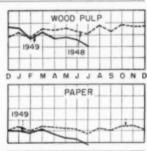


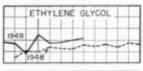
100-Monthly Average 1947

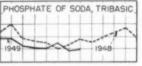


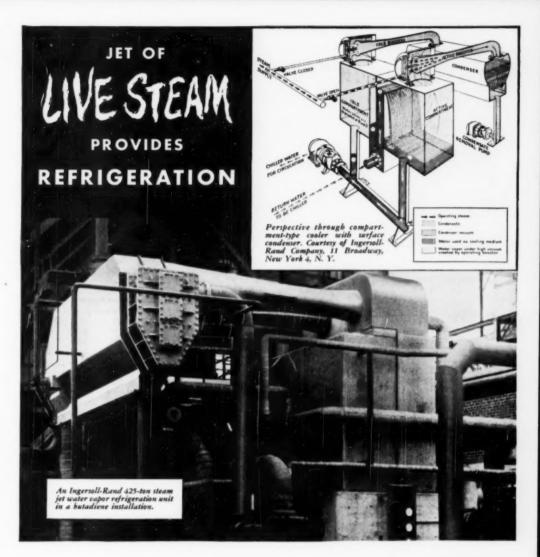


1949









Large steam jet ejectors, while based on a relatively old principle, are today utilized to produce refrigeration. In its new dress, a jet of live steam at 2 psig or more darting in a properly-designed venturi tube greatly reduces the pressure over warm water. The jet also removes water vapor, thereby maintaining the vacuum and lowering the temperature of the water to that at which it boils, which may be as 10w as 35° F. Such coolers are in use today in many industries, such as:

PAPER - MARINE - BREWING - FOOD RUBBER - CHEMICAL - OIL REFINING AIR CONDITIONING - GAS PRODUCTION EXPLOSIVES Revere is interested in this development for two reasons. First, it is a fine example of the way in which American enterprise uses its intelligence and initiative to obtain new values from old ideas. Second, the coolers use steam and water, and require nonrusting copper alloys of high heat conductivity in such forms as condenser and heat exchanger tubes and plates, which Revere makes. . . . Revere has a great deal of information about its alloys and their applications to various conditions of use. Why not use that knowledge as well as our metals? The Technical Advisory Service will gladly cooperate with you.



#### ETHYL ALCOHOL—II

JOHN R. SKEEN

Industrial alcohol, derived from dozens of raw materials and used almost everywhere, has been a center of conflicting interests throughout its commercial history of less than 50 years. Second only to water in solvent value, ethanol is employed in nearly all industries: drug, food, cosmetic, resin, explosives, polishes, coatings and many others. In addition, it is a starting point for making hundreds of chemicals including acetaldehyde, ethyl acetate, acetic acid, ethylene dibromide, glycols and ethyl chloride. Still a factor as an anti-freeze, alcohol offers some promise of extending its market in the field of motor fuels, This ubiquity probably accounts for the survival of the industry in spite of the keenest and most varied competition, and handicaps imposed by gov-

IOHN R. Skeen is market research director for Foster D. Snell, Inc.

ernment. These factors continue to operate and have produced a postwar plethora in contrast to the wartime dearth.

Slightly less than 200 million gallons were produced during the fiscal year just ended. The installed capacity was nearly double this amount of which synthetic processes accounted for 30 percent, the fermentation of molasses over half, and grain about 14 percent. As the synthetic plants approached maximum operation, they contributed over half that made. This has been the recent trend and necessitated drastic action on the part of the fermenters in order to retain an appreciable share of the market. Pubicker Industries provided a solution, however temporary.

Last November molasses sold at 23c. per gal. and so determined the price of alcohol at the 70-80c. level. To effect a reduction without loss it

was necessary to obtain the raw material for less. Publicker contracted with the Cuban Government to supply molasses at a price tied to that of the product alcohol. A succession of reductions immediately followed. In May alcohol was offered at 17c. and molasses was obtained for 4c. The Cuban Government canceled the contract. It is generally agreed that profits at that price are not possible although the synthetic industry may be excep-

Among the elements contributing to these events are the excess of facilities, the lower cost of ethylene and the government policy of supporting the price of farm crops. In 1940 synthetic capacity was 38 million gal-lons and that of the industrial fermenters over five times as much. Consumption averaged about half this amount. However, anticipated needs to make synthetic rubber, military explosives, acetaldehyde for rayon and butanol, ethyl chloride and ethylene dibromide for tetraethyl lead, and the expanded demand of the lacquer industry presented a truly critical situa-tion. Estimated requirements varied with time and the agency. Rubber

(Continued)

#### Industrial Alcohol Supply and Consumption (Unit million wine gallons of 190 proof)

| - |                             |
|---|-----------------------------|
|   | Total Colonial Colonial Co. |

|                                      | App  | man subbi                            | A-Lota                               | Inquatru                                 | at Amonor-                      |                                      |                                     |                                      |                                       |                                      |                                    |                             |                                      |                                      |                                 |
|--------------------------------------|--|--------------------------------------|--------------------------------------|--|---------------------------------|--------------------------------------|-------------------------------------|--------------------------------------|---------------------------------------|--------------------------------------|------------------------------------|-----------------------------|--------------------------------------|--------------------------------------|---------------------------------|
|                                      |  |                                      | Prode                                | artion                                   |                                 |                                      |                                     |                                      |                                       |                                      |                                    |                             |                                      |                                      |                                 |
|                                      |  | Indust                               | trial Plan                           | te                                       |                                 |                                      |                                     |                                      |                                       | Industrial C                         | onsumption                         | -Decarate                   | d Alcohol*                           |                                      |                                 |
|                                      |  | Synth                                | etic                                 |  |                                 |                                      |                                     |                                      | Che                                   | mirala*                              |                                    |                             | Sul-                                 | eenta!!                              |                                 |
| Fiscal Year                          | Apparents<br>Supply<br>(not)               | Ethyl Sulphates                      | Total                                | Others                                   | Dus-<br>tilleries <sup>10</sup> | Bucke                                | Importet                            | Anti-<br>freeze <sup>2</sup>         | Totalte                               | Acctalde-<br>hyde <sup>10</sup>      | Ex-<br>plosives*                   | Rubber <sup>10</sup>        | Total                                | Proprie-<br>tary <sup>17</sup>       | Eltheri                         |
| 1935<br>1936<br>1937<br>1938<br>1939 | 96.3<br>105.2<br>113.3<br>103.6<br>106.1   | 9 3<br>16.6<br>17.8<br>18 6<br>25 3  | 9.3<br>16.6<br>17.8<br>18.6<br>28.4  | 85.7<br>86.6<br>90.1<br>87.2<br>90.4     | #144<br>#441<br>#141<br>#141    | 13.3<br>11.2<br>15.0<br>16.8<br>16.3 | 0.1                                 | 34 0<br>32 1<br>10 5<br>22 6<br>15 1 | 33.9<br>44.7                          | 11.7<br>19.0                         | 0.2                                |                             | 26 2<br>43 2                         | 10 6<br>16 7                         | 2 1 1 5                         |
| 1940<br>1941<br>1942<br>1943<br>1946 | 132 5<br>162 9<br>281 1<br>294 1<br>503 5  | 32 2<br>36 8<br>47 7<br>50 9<br>50 9 | 32 3<br>37 0<br>45 7<br>51 9<br>90 9 | 96.0<br>120.3<br>174.8<br>183.8<br>274.8 | 48 8<br>149 8<br>184 2          | 11 5<br>41 0<br>131 3<br>75 1        | 0.2<br>4.9<br>17.1                  | 17.4<br>10.0<br>32.0<br>21.8<br>46.0 | 57.8<br>70.7<br>74.8<br>96.1<br>111.9 | 24.6<br>30.3<br>34.4<br>44.7<br>30.7 | 1 0<br>5 6<br>26.8<br>30.3<br>16.7 | 30.4<br>204.0               | 45 2<br>54 2<br>50 6<br>43 7<br>40 6 | 17 5<br>23 0<br>24 5<br>15 4<br>21 7 | 1 2<br>1 4<br>2 6<br>3 9<br>4 1 |
| 1985<br>1986<br>1987<br>1988<br>1988 | 000 7<br>200 3<br>206 6<br>180 Sh<br>192 3 | 56.8<br>67.1<br>70.2<br>73.8<br>89.0 | 30.8<br>68.1<br>71.4<br>74.7<br>98.1 | 200 9<br>118 0<br>39 6<br>100 2<br>86 6  | 219.9<br>46.8<br>n              | 84.1<br>74.1<br>14.2<br>26<br>26 8   | 40.8<br>24.9<br>16.6<br>17.8<br>0.2 | 20 1<br>33 0<br>32 0<br>30 7         | 100.3<br>81.8<br>93.6<br>101.4        | 56.7<br>54.0<br>65.6<br>72.9         | 18.1<br>0.9<br>0.1<br>0.1          | 315.9<br>62.7<br>9.3<br>0.6 | 40.9<br>80.0<br>83.1<br>46.9         | 19.6<br>18.4<br>21.4<br>15.3         | 4 G<br>2 1<br>2 7<br>2 8        |

| Unless otherwise stated, all data from Alcohol Tax Unit: Stitution on User, Stitution on Ethyl Alcohol, The Annual Registr of the Commissioner of Infarrial Reservae.
| While the records in the ATU will permit a balance of the elements of net supply with total withdrawals. "It is impossible to establish a balanced account from only the elements of net supply in the ATU will permit a balance of the elements of net supply with total withdrawals." It is impossible to establish a balanced account from only the elements of the elements of net supply in the ATU will permit a balance of the elements of th

\* Chemical conversion exclusive of synthetic rubber.

\* Solvent use as reported.

\* Synthetic, exclusive of accelerators.

\* Synthetic, exclusive of accelerators.

\* In Indice's persons of the completely denatured alcohol and minor specially denatured uses-fuel, fluid, laboratory.

\* In Indice's persons of the completely denatured alcohol and minor specially denatured uses-fuel, fluid, laboratory.

\* In Indice's persons of the completely denatured alcohol and minor specially denatured uses-fuel, fluid, laboratory.

\* In Indice's varieties of the supply: 1942-45; "distillers" equals "set you will be used to be

Men minor amounts of other alderbyone.

Costings, plastics, resins, cosmetice, processing food, drugs and industrial processor.

Costings, plastics, resins, cosmetice, processing food, drugs and industrial processor.

Cartale and Carthon Chemicals Corp. and Enco-Standard Oil Co.

Cartale and Carthon Chemicals Corp. and Enco-Standard Oil Co.

Cartale and Carthon Chemicals Corp. and Enco-Standard Oil Co.

Cartale and Carthon Chemicals Corp. and Enco-Standard Oil Co.

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Cartale and Carthon Chemicals Corp. and Enco-Standard Oil Co.

Cartale and Carthon Chemicals Corp. and Enco-Standard Oil Co.

Cartale and Carthon Chemicals Corp. and Enco. Here are minor and byproducts.

Increased London Corp. and Corp. and Carthon Corp



#### **Pilot Plant Results** and Operating Data-

CORROSION CONTROL PROJECTS MAKING USE OF THE NEW

arpenter Stainless Tubing No. 20



This new Stainless is ideal for solving a great many corrosion problems, but is not recommended in some cases. To conduct tests which will be similar to your operating conditions, order test pieces of Carpenter Stainless Tubing No. 20, giving us data on the corrodents, temperatures and processes involved.

These engineering reports on Carpenter Stainless Tubing No. 20-along with bar stock, strip, wire, sheet and plate-show typical results where No. 20 has solved difficult corrosion control problems.

| CORRODENT              | RESULTS                             | CCRRODENT                   | RESULTS  |
|------------------------|-------------------------------------|-----------------------------|--|
| Aluminum Sulphate plus | Excellent, no sign of pitting after | Sulfuric Acid 2/3% @ 68°    | Carpenter Stainless No. 20                                       |
| Alumino @ 245°F        | 35 working days.                    | to 212 F                    | showed no appreciable loss of<br>weight due to corrosion (.00012 |
| Concentrated Chlorine  | Type 304 pitted, No. 20             | 4                           | IPY).  |
| Solution               | satisfactory.                       | Sulfuric Acid 1/105%        | Approx. 8 times as resistant as<br>lead. Expected equipment life |
| Maleic Acid            | Excellent (better than Type 316).   | Sulfuric Acid 10% @         | 4 years with Stainless No. 20.                                   |
| Phosphoric Acid        | Excellent, Corrosion rate ob-       | 140 160°F                   | Excellent.   |
|                        | tained: .0180 IPY.                  | Zinc Phosphate plus approx. | Estimated 10 to 30 times life of                                 |
| Sulfuric Acid 15/50%   |                                     | 5% Sodium Chloride @        | Type 302 or 304. Total exposure                                  |
| @ 68°F                 | Excellent,                          | 180°F                       | during test: 460 hours.  |



#### Technical Data Sheets Available

For useful information on the types of jobs that can be handled by No. 20, send a note on your company letterhead and ask for the Carpenter Stainless No. 20 Data Sheets.

THE CARPENTER STEEL COMPANY - ALLOY TUBE DIVISION -105 Springfield Road, Union, N. J.

Carpenter Stainless No. 20, similar in analysis to Durimet 20, is now available in the forms of Tubing and Pipe, Sheet and Plate, Bar Stock, Wire and Strip.





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#### PULVERIZING TRITURATING SHREDDING DEFIBERIZING DISPERSING





#### DISINTEGRATORS

last longer\*

because of heavy duty construction, very heavy shaft, manganese steel ham mers, and heavy gauge heat-treated

#### 12 STANDARD MODELS

S to 300 HP-Stainless Steel Optional

versatile because each machine designed and tested for high speed (3600) operation, but provided with motors of either 1800 RPM or 3600 RPM, depending on application.



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See our exhibit—Booth 648 New York Chemical

#### COMMODITY SURVEY, cont. . .

became the determining and uncer-tain factor. By mid-1942 it was thought that 213 million gallons would be needed annually to make the necessary butadiene and styrene. Within six months this estimate was raised variously to 315 million gallons. Then, too, it could not be said when the highly integrated rubber plants would be synchronized and so a storage problem for alcohol was posed. Only one thing was certain-much more alcohol was needed than the industry could supply.

The first major constructive measure was advocated by the Division of Civilian Supply (later Office) and, during the summer of 1941, the Chemicals Branch initiated a program for production. The conversion of distilleries from beverages to the industrial product followed. Nearly 250 million gallons were expected to be contributed by 135 distillers. Be-

cause of the uncertainty of the molasses supply, eastern industrial plants were prepared for the use of grain. This involved a capacity of over 90 million gallons and imposed equipment changes for grain handling, "cooking" and "slop" disposal. The wide use of grain was predicated upon the assumption that the supply of corn was almost inexhaustible. However, the Commodity Credit Corp. soon insisted that wheat be used to the extent of 50 percent and numerous technical difficulties followed.

With all this activity in old centers, agitation developed for establishment of the industry in the West. Early in 1943 grain plants rated at 41 million gallons were authorized to be built at Kansas City, Omaha and Muscadine, Iowa. These began operation in January and later in the next year. Two used potatoes and potato flour. Meantime, 18 million gallons of new synthetic became avail-(Continued)

Ethyl Alcohol: Approximate Capacity and Price

| (Cuit: mimon                                   | wine gan                     |                                      | Synthetic Al                                       | cohol <sup>2</sup>                         |                                      |  |                            |                       |                                       |
|--|------------------------------|--------------------------------------|--|--|--------------------------------------|--|----------------------------|-----------------------|---------------------------------------|
|  |                              | Carbide a                            | nd Carbon (  | Th. Corp. 1                                | Essa-Std                             |  | Cts                        | hert                  |                                       |
| Fiscal Year Tota                               |                              | S. Charles-<br>ton<br>W. Va.<br>S. 5 | Whiting Ind.                                       | Texas<br>City<br>Tex. <sup>10</sup>        | Beton<br>Rouge<br>La. <sup>11</sup>  | Other?                                     | In-<br>destrial<br>Plantes | Dis-<br>tillenes      | Pricet<br>c./gal.<br>39.9             |
| 1935<br>1956<br>1937<br>1939 430               | 19 5<br>19 5<br>19 5<br>19 8 | 9.5<br>9.5<br>9.5<br>8.5<br>26.58    | 11 6<br>11 0<br>11 0<br>11 0                       |  |                                      |  |                            |                       | 29 9<br>29 7<br>25 3<br>26 3<br>23 1  |
| 1940<br>1941 . 501<br>1942 . 616<br>1943 . 736 | 41                           | 26 5<br>26 5<br>26 5<br>26 7<br>28 7 | 11 0<br>12 5 <sup>17</sup><br>12 5<br>12 8<br>12 8 | 9 5<br>9 5<br>16 50<br>15 5                | 16 0<br>16 0                         | 1.0  | 315<br>340m<br>377m        | 227<br>227**<br>206** | 21.6<br>26.4<br>40.1<br>52.0<br>80.0  |
| 1945<br>1946<br>1947<br>1948<br>1949 787       | 76.7<br>76.90<br>79.6        | 26.7                                 | 12 S<br>12 S<br>12 S<br>12 S<br>12 S<br>12 S       | 19.5<br>19.5<br>19.5<br>19.5<br>19.5<br>36 | 16 0<br>16 0<br>16,0<br>19,0<br>19 0 | 1.0<br>1.0<br>1.2<br>0.9<br>18.90<br>23.90 | 405 Sat                    | 266 <sup>28</sup>     | 50.0<br>52.5<br>74.6<br>91.4<br>51.15 |

<sup>1</sup> Expressed on a fixed year basis, i.e. a plant of rated capacity which began or could have begun operation before June 30, in aircluded in the year ending on that date, for consistency, price also expressed in fixed years.
<sup>2</sup> Potential expactly assuming all conversions and operations.
<sup>3</sup> As plant capacities have been estimated or are readily deducible from other published information, the record is presented here.

and ners.

4 First year basis as recapitulated from Bureau of Labor Statistics data; specially denatured, formula no. 1, 190 proof, ikas fob. East. Tarika, fob. Estanton have been published including 1944: 79-45 million gallons, Aicobel from Agriculture Commodition, P. Burke Many-retination have been published including 1944: 79-45 million gallons, Aicobel from Agriculture Commodition, P. Burke Agriculture (Commodition) and Agriculture, 1949: estimates vary from 111 to 130 million gallons; 1950: total may be close to 130

\*Many estimates have been sensitive; 1949: estimates vary from 111 to 130 minon general.

\*Agriculture; 1949: estimates vary from 111 to 130 minon general.

\*From ethyl sulphate.

\*\*Reported as synthetic as required by law; 1939-50; includes by-preduct alcohol such as from carlson nonoxide-hydrogen reported as synthetic as required by law; 1939-50; includes by-preduct alcohol such as from carlson nonoxide-hydrogen reported as synthetic as required by law; 1939-50; includes 139 and Calco and Hercules shortly after; Calco many carlson from 1941-194; by-preduct agastries have been estimated at 2.8 million gallons by above, i.e. cri.

\*Normally producing industrial alcohol as contrasted with beverage alcohol—i.e. tax-free; includes 120-130 million gallons reported from 130-150 proof.

\*Normally producing alcohol directly or indirectly for beverage purposes only—i.e. tax paid, represents capacity to make 100 proof.

\*Normally producing alcohol directly or indirectly for beverage purposes only—i.e. tax paid, represents capacity to make 100 proof.

\*Normally producing alcohol directly or indirectly for reducing purposes only—i.e. tax paid, represents capacity to make 100 proof.

\*Normally producing alcohol directly or indirectly for reducing purposes only—i.e. tax paid, represents capacity to make 100 proof.

\*Normally producing alcohol directly or indirectly for reducing purpose on the 1941.

\*Plant began for 1942 million gallons and a capacity of 100 million gallons began was attained about 1948.

\*Include Schol Chemical Co. at Deer Park, Fex.—19 million gallons began 0et. 1948.

\*Include Schol Chemical Co. at Deer Park, Fex.—19 million gallons, began 0et. 1948.

\*Include Schol Chemical Co. at Deer Park, Fex.—19 million gallons began 0et. 1948.

\*New capacity began duce 1949.

\*New capacity began duce 1949.

\*New capacity began duce the person and none efficient recoveries; not plant expansion.

\*New capacity began duce duce disconnent of the recessary equipment was completed.

\*New Capacity began duce 1949.

\*New C

a hyproduct.

31 Smith Hearings, p. 153, also see p. 810; potential after conversions and additions; new facilities amount to 25 million

lloss.

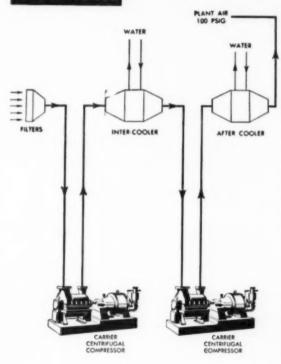
■ Alcohol from Industrial Commodifies, i.e., cif. exclusive of butyl plants, assumes operation at 350 d./yr., potential expanity

\*\* Afficial from Foldertical Commodities, not. the extractor of many folders assumes operation at 3-30° a, 78°, potential capacity from installed facilities.
\*\* Guidatt Hearings, Vol. 1, (100)\* "industrial alexaloit" includes 127 million gallons obtained from distilleres for redstillation. to 100 proof and this amount is included, maximum capacity from installed facilities.
\*\* South Hearings, 1942, p. 10°, see also p. 507—292 million gallons; potential capacity after new facilities and conversions, 2 Eleven-month average, 2014, 504.

#### PROBLEM:

How to get large volumes of plant air

#### **SOLUTION:**



Thus diagram shows how Carrier Centrifugal Compressors in series easily compress air up to 100 PSIG or even higher. Like other rotating machinery (steam turbines, centrifugal pumps), they do the large jobs better at less cost than by any other means.

Carrier Centrifugals compress air without pulsation — a result important to flow measurement or catalyst beds. Process air is not contaminated by compressor lubricating oil. Efficiency is high for partial loads and is sustained for the life of the equipment. Ruggedly built to Carrier's exacting standards, these compressors operate for years free of the maintenance problems on valves, pistons, etc., that arise with reciprocating equipment. Space requirements are low.

Standard Carrier Centrifugal Compressors with intake volumes between 7000 and 30,000 cfm at discharge pressures of 100 PSIG are available for this application. They are adaptable to direct turbine or motor drives, and can readily be fitted into the plant heat balance.

Carrier is qualified through years of research and experience to help with problems involving large volumes of air and gases. And a staff of Carrier-trained engineers is readily available for consultation. Carrier Corporation, Syracuse, New York.



CENTRIFUGAL COMPRESSORS . REFRIGERATION EQUIPMENT

COMMODITY SURVEY, cont. . .

able. In addition, a 2 million gallon sulphite plant was erected at Bellingham, Wash., and a wood hydrolysis project at Springfield, Ore., capable of making 4 million more. The net result was that the industry added nearly 80 million gallons to the capacity existent in 1941. The problem became one of how to use it.

With the end of hostilities, distilleries and wineries reverted to beverage production, natural rubber returned and the synthetic rubber schedule was reduced. As butadiene from petroleum sources was far less expensive than from ethanol, the alcohol-butadien plants were discontinued. Thus another major market was lost to petroleum chemistry. Of the 350-360 gal, capacity operated by industrial alcohol producers at the end of the war, hardly more than 200 were regarded by many as being "reasonably economic." The price of grains was prohibitive. One authority is of the opinion that potatoes are an unprofitable source at any price, i.e. free. The record of sulphite and wood waste operations appears to be unpromising except under unusual conditions. Two years ago, synthetic processes dominated the supply with molasses a poor second. Only molasses offered

opportunity for reducing costs of fermentable materials.

With the rise of the chemical industry, England made available a denatured, tax-free alcohol nearly a century ago. Germany followed. It was not until 1906 that industrial value was recognized domestically when the tax-free bill was passed by Congress. The industry may be said to date from then and as a byproduct of beverage production.

The first World War created a demand for the manufacture of smokeless powder, mustard gas, airplane dope, TNT and other chemicals. Production of denatured alcohol increased from 10 to 50 million gallons within five years. This meant the creation of a separate industry operating from molasses imported to Philadelphia, Bultimore and New Orleans. In addition, four wood fermentation plants were creeted and operated in Illinois, Mississippi, South Carolina and Louisiana. Three others produced from sulphite pulp in New York, Wisconsin and Pennsylvania. The sharp drep in price which followed peace saw the discontinuance of all except the new molasses plants. These dom: nated the domestic supply until recent years. The installation of the U. S. Industrial Alcohol Co. at Curtis Bay was the world's largest unit.

PULVERIZER COMPANY

1219 Macklind Ace.

St. Louis 10, Mo.

This company also pioneered the use of alcohol as a motor fuel in 1918. For two years a 10-90 blend of anhydrous alcohol and gasoline was offered under the name of Alcogas. The market was unreceptive. However, the automobile created a major new outlet in anti-freeze and alcohol was supplied. New uses multiplied. In 1924. alcohol was first used commercially to make ethyl chloride, tetraethyl lead and ethyl cellulose.

In these years the young industry was subjected to the added rules and penalties attendant to the effort to enforce Prohibition. The use of the new and partially competitive solvents -butanol, isopropanol and glycolwas encouraged. In spite of this, the the Carbide and Carbon Chemicals Corp. obtained a 30-day test permit from the Prohibition Commissioner in May 1929 in order to make synthetic alcohol. Commercial production began the next year. Today, Carbide is the largest domestic maker. Of the fermentation group, the dominant suppliers are Publicker, U. S. Industrial Chemicals, E. I. du Pont de Nemours & Co. and Commercial Solvents Corp. As a result of recent events, many are of the opinion that the synthetic product will capture most of the market. Already great strides have been made.



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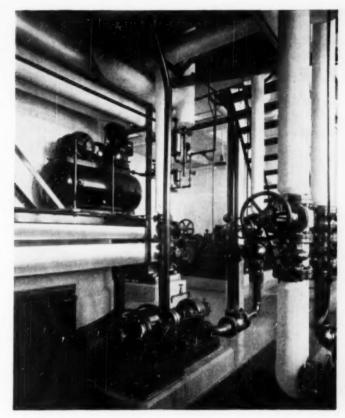


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Oristnators and Manufacturers o

Ring Crushers and Pulverizors



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#### Where K&M "Featherweight". 85% Magnesia Keeps up steam...keeps down cost...for 14 miles

Pratt & Whitney Division of Niles-Bement-Pond Company, West Hartford, Conn., has long been noted for fine machine tool, cutting tool and precision gauge manufacture. The scientific attitude is a Pratt & Whitney habit. They applied it to saving b. t. u.'s along 14 miles of steam lines throughout their large power plant and shops. That led them to use K&M "Featherweight" 85% Magnesia pipe insulation for maximum efficiency and permanence.

The inherent insulation effectiveness of K&M "Featherweight" 85% Magnesia comes from

basic Carbonate of Magnesia. This is combined with clean Asbestos Fibre in correct proportion for needed weight-saving strength. Therefore it is easy to do a fast, shipshape insulation job whose continued efficiency does not depend on costly maintenance.

Designed for temperatures to 600° F., K&M "Featherweight" 85% Magnesia comes in all standard sizes. Like the other K&M insulation materials, it can save you waste—difficulty—money. Get help on any points by consulting your nearest K&M Distributor—an insulation expert.

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Binks Rotojet nozzles produce an exceedingly fine fluid break-up in the form of a hollow cone, with maximum efficiency at minimum pressure.

Designers and engineers appreciate their trim compactness, complete atomization and clog-proof characteristics, along with the fact they can be made in corrosion-proof metals for the chemical industry and special-purpose equipment.

Binks engineers will gladly assist with your problems of designs involving the use of spray nozzles, for any purpose, without cost or obligation.

Send loday for your free copies of Bulletins 10 and 12, which describe Rotojet nozzles fully, with

complete engineering data for each size. Please state capacity required and application intended.

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#### United States Production of Certain Chemicals

| Chemical (Tunu unless otherwise neted) Ammonia, synthetic, anhydrous! Ammonia, manipulatic, synthetic (M lb.) Calcium areases (M lb.) Calcium areases (M lb.) Calcium (Carbon dissipation)  | June  | June  | May  | May  |
|---|---|---|--|--|
|   | 1940  | 1948  | 1949   | 1945   |
|   | 160,217   | 91,844  | 110,129  | 92,466   |
|   | 36,886  | 70,380  | 93,366   | 76,000   |
|   | 40,186  | 29,134  | 43,008   | 29,632   |
|   | 1,790   | 5,488   | 1,515  | 3,369  |
|   | 47,424  | 54,583  | 45,804   | 80,009   |
| Liquid and gas (M lb.) Solid (M lb.) Collorine Chrome grees (M lb.) Chrome press (M lb.) Chrome press (M lb.) Hydrogen (M cu. lb.) Hydrogen (M cu. lb.) Hydrogen (M cu. lb.) Molybalate chrome ornage, (C.P.) (M lb.) Molybalate chrome ornage, (C.P.) (M lb.) Oxygen (M cu. lb.) Phomphorie acid (80 percent HaPOs) Soda acid. | 94,771<br>91,997<br>134,872<br>701<br>2,485<br>34,833<br>2,003<br>794<br>279<br>97,476<br>1,049<br>97,644 | 21,388<br>92,462<br>133,221<br>456<br>4,306<br>34,930<br>2,207<br>2,007<br>500<br>81,888<br>1,289<br>95,396 | 22,184<br>61,481<br>143,718<br>486<br>2,004<br>27,825<br>2,181<br>711<br>347<br>99,800<br>1,286<br>111,040 | 29,900<br>78,317<br>130,925<br>1,007<br>3,671<br>38,349<br>2,304<br>3,127<br>86,487<br>1,370<br>98,565 |
| Ammonia-coda process: Total wet and dryt. Finished light? Finished light? Finished light? Solium burationate, refined Solium burationate, refined Solium burationate.   | 309,379   | 347,656   | 285,741  | 360,110  |
|   | 152,667   | 179,962   | 130,208  | 174,450  |
|   | 114,015   | 111,130   | 103,144  | 125,350  |
|   | 17,820  | 26,837  | 17,565   | 25,418   |
|   | 11,341  | 11,966  | 11,508   | 13,387   |
|   | 4,648   | 7,916   | 5,296  | 7,962  |
| Electrolytic process: Liquids Solid   | 126,568   | 130,496   | 134,523  | 125,100  |
|   | 18,834  | 23,007  | 19,835   | 23,383   |
| Lime-noda process Liquid Solid Sodium phosphate   | 43,715  | 60,080  | 42,1%0   | 00,165   |
|   | 11,499  | 18,177  | 12,4%6   | 19,109   |
| Monobasie Dibasie Tribasie Meta Meta Teris Soltan silicate, anhydrons   | 1,017<br>8,986<br>5,016<br>1,907<br>5,457<br>37,658   | 5,457<br>6,032<br>2,716<br>4,919<br>39,093  | 9,150<br>6,236<br>2,019<br>5,566<br>43,277   | 1,060<br>5,756<br>5,564<br>2,937<br>5,205<br>33,589  |
| Anhydrous   | 8,697   | 13,263  | 10,863   | 12,876   |
| Glauber's miles   | 8,411   | 15,029  | 11,277   | 15,828   |
| Sult reaker   | 39,976  | 50,573  | 43,208   | 37,682   |
| Sulphurie acid*. † Chamber process. Contact process, new  | 201,24%   | 219,53%   | 222,435  | 262,200  |
|   | 597,283   | 567,262   | 654,482  | 613,646  |

Data for this tabulation have been taken from "Facts for Industry" series issued by Bureau of the Census. Production figures represent primary production and do not include purchased or transferred materials. Quantities produced by government-owned arsenals, ordnance works, and certain plants operated for the government by private industry are not included. Chemicals manufactured by TVA, however, are included. All tons are 2,000 lb. Where no figures are given data are either confidential or not yet available. Includes a small amount of squa ammonia. Total wet and dry production, including quantities diverted for manufacture of causetie soda and sodium bicarbonate, and quantities processed to finish light and finished dense. "Not including quantities with the confidence of the production of liquid materials, including quantities evaported to solid caustic and reported as such. "Includes oleum grades, excludes spent acid. Total for sulphuric acid manufactured as a byproduct of smelting operations are included.

#### United States Production of Synthetic Organic Chemicals

| Chemical  | June<br>1949 | 200c<br>1948 | May<br>1949  | May<br>1948 |
|---|--------------|--------------|--|-------------|
| Acetanilid  | 560,693      | 142,166      | 521,107  | 170,791     |
| Acetine acid: Synthetic! Recovered Natural! Acetine Acetine Acetine Acetine Acetine |              |              | 27, 987, 015<br>03, 737, 024<br>1, 034, 121<br>30, 774, 530<br>33, 410, 177<br>939, 913<br>5, 529, 310 |             |

(Continued on page 322)

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This brand new, comprehensive bulletin, illustrates and describes the Airveyor, a pneumatic conveying system, for unloading and conveying pulverised and granular materials from cars, trucks, ships and barges; reclaiming from storage for transporting to process bins throughout the plant; blending and mixing by weight or volume.

This 24-page bulletin contains photographs and drawings showing how the Airveyor is used in various industries, such as, for example, paper mills; breweries; distilleries; rubber-processing plants; soap manufacture; filtration plants; food-products plants; unloading grain from ships and barges; and other applications in the chemical-process industry.

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A-103



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## LAYNE WELLWATER Systems

ASSOCIATED COMPANIES: Lorenthianas Companies of the State of the State

### U. S. Production of Synthetic Organic Chemicals, cont. from page 320

| Cheminal  | June<br>1949 | June<br>1949 | Vay<br>1949       | May<br>1948  |
|---|--------------|--------------|-------------------|--------------|
| Barbiture and derivatives   |              |              |                   |              |
| \$-Ethyl-5-Phenylbarbituric acid and salts (phenobarbital)  | 20,638       | 15.553       | 22,900            | 19,437       |
| Bensene   | 20,000       | 10,000       | 00,000            |              |
| Motor grade:  |              |              |                   |              |
| Cone oven operators   | 2,633,297    | 787,513      | 2,613,303         | 919,070      |
|   | 2,000,000    | 101,000      | 21010100          |              |
| Tar distillers  | 619, 204     | 1.000.773    | 929,150           | 1,123,305    |
| Coke oven operators   | 9.788.060    | 11,864,980   | 11,220,088        | 12,161,976   |
| Butyl alcohol, primary, normal  | 8,495,578    |              | 9,946,991         | 10.103.815   |
| Carbon bisulphide   | 27,501,173   | 32,791,973   | 26,237,968        | 37,533,338   |
| Carbon tetrachloride  | 13,673,903   | 15,971,606   | 13,607,213        | 17,251,426   |
| Chlorobengene, mono   | 12,999,617   | 23,663,814   | 17,162,002        | 24,226,129   |
| Crowste oil:  | 14,000,011   | maragaran .  | N.C. T. COMP. CO. | 24,280,180   |
| Tar distillers  | 11,657,907   | 7.666.515    | 11,478,268        | 8,644,171    |
| Coke oven operators   | 2,164,523    | 2,987,068    | 2,249,991         | 2,946,314    |
| Cresols, meta-para  | 331,414      | 735,469      | 235, 268          | 6,663,632    |
| Cresols, ortho-meta-para  | 201,914      | 812,757      | 500,916           | 908,665      |
| Creson, ortho-meta-para   | 1,927,932    | 2,742,977    | 1,749,079         | 2.715.342    |
| Cresylic acid, refined7. 18   | 1.3 (2.347   | 615.563      | *11*******        | 1,428,480    |
| Dubutyl phthalate<br>Dehlorodiphenyltrichloroschane DDT   | 3,125,185    | 355, 262     | 2,989,012         | 552,64×      |
| Ethyl scetate (% percent)   | 5.479.319    | 5,762,529    | 5,36%,293         | 5,787,618    |
| Ethyt acetate (Na percent)  | 37,615,099   | 30,741,797   | 36,679,833        | 32, 144, 429 |
| Ethylene glycol   | 3.036,203    | 2,979,121    | 2.346.172         | 3.218.547    |
| Ethyl ether<br>Formaldehyde, 37 percent b. wt   | 41,262,795   | 45,658,213   | 29,519,779        | 55,030,124   |
| Formaldenyde, 37 percent n. wt<br>Hexachlororyclohexane   | 1,239,482    | 936.083      | 888.32s           | 1,769,200    |
| Hermonoracionermos  | 970,303      | 1,335,078    | 000,000           | 1,348,922    |
| Methanol, natural   | 45, 533, 523 | 85,519,953   | 58,857,386        | 84,800,442   |
| Methanol, synthetic   | 49,930,023   | 20,019,903   | 25,501,250        | 58,500,492   |
| Naphthalene   | 9,495,052    | 16,997,455   | 6.200.370         | 17,827,164   |
| Tar distillers, less than 70° C   |              | 8,421,981    | 4,972,931         | 7,986,181    |
| Tar distillers, 79° C. and over<br>Coke-oven operators, less than 79° C.<br>Penicillin and salts: | 5,138,878    | 7,888,496    | 6,533,965         | 8.052.261    |
| Coke-oven operators, less than 79° C.   | 5,217,671    | n_0=0_5==    | 11.845.327        | 8,505,435    |
| Penedlin and salts  |              |              | 19, 995, 998      | 23,708,307   |
| Phenol  | 14,152,534   | 22,936,803   |                   | 13,631,777   |
| Phthalie anhydride  | 8,017,853    | 11,606,215   | 9,517,421         | 35,501,400   |
| Styrene, government and private plant   | 28, 286, 193 | 31,035,013   | 32,089,036        | 30,001,000   |
| Tolurar:  |              |              | 0.000.000         | 0.005 143    |
| Coke-oven operators   | 2,226,391    | 2,463,296    | 2,497,671         | 2,355,183    |
| All others  | 3,306,925    | 3,932,823    | 4,815,042         | 4,082,063    |
| Xylene, crude   | 5,364,446    | 6,147,291    | 4,924,5%          | 5,632,101    |

All data in pounds except benzene (gal.) creesete oil (gal.), toluene (gal.) Xylene (gal.) and penicillin (million Oxford units). Statistics collected and compiled by U. S. Tariff Commission except where noted. Absence of data on production indicates either that returns were unavailable or confidential. 'Excludes the statistics on recovered acid. 'Acid produced by direct process from wood and from calcium acetate. 'All acetic anhydride including that from acetic by vapor-phase process. 'Product of disciblers who use purchased coal tar only or from oil-gas or water-gas produced or purchased by tar distillers. 'Statistics are given in terms of bulk medicinals only. 'Statistics collected' by Bureau of Mines. 'Total production including data reported both by coke-oven operators and by distillers of purchased coal tar. 'Reported to U. S. Bureau of the Census. 'Includes toluene produced from petroleum by any process.'



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### **NEW CONSTRUCTION**

### Proposed Work

- Calif., San Francisco—General Petrole and Corp., 417 Montgomery St., plans to reconstruct its Islais Creek plant. Estimated cost will exceed \$70,000.
- Conn., Hartford—Standard Paper Co., 302 Market St., plans to construct a warehouse. Robert W. Loomis, 32 Maple Ave., Windsor, Conn., Struc. Engr. Estimated cost 565,000.
- Neb., Morrill—Chemical Corps, Inc., Scottsbluff, plans the construction of a processing plant here. Estimated cost \$75,000.
- N. J., Vineland—Kimbel Glass Div. of Owens-Illinois Glass Co., 405 Madison Ave. Toledo. O., plans the construction of Watchouse No. 32. W. W. Weullner, c/α owner, Archt. Estimated cost \$150,000.
- O., Cleveland—Standard Oil Co. of Ohio, 2735 Broadway Ave., plans to construct small naptha tanks at its refinery here. Estimated cost \$100,000.
- Tenn., Chattanooga—Tennessee Products & Chemical Corp., Alton Park, plans to rebuild its chemical plant. Estimated cost will exceed 5300,000.
- Tex., Chesterville—Del Ray Petroleum Co., N. Esperson Bldg., Houston, plans to construct a gasoline refinery here. Estimated cost \$1,000,000.
- Utah, Marysvale—Green River Exploration Co., Salt Lake City, plans to construct a uranium ore mill near here. Estimated cost \$500,000.
- Wash, Scattle—Standard Oil Co. of California, 225 Bush St., San Francisco, Calif., plans to construct new petroleum accessories and repair warehouse, also 22 storage tanks with a capacity of 154,000 bbls., pier, garage, boiler and pump houses, loading tack and bulkhead. Estimated cost \$1,000,000.
- Ont., Samia—Sun Oil, Ltd., 29 Basin St., Toronto, Ont., has leased a 150 acre site here and plans to construct an oil refinery. Estimated cost \$20,000,000.
- Que., Lachine—Vi-Lut Candle Mfg. Co., Ltd., St. foseph St., plans to construct a candle manufacturing plant. Estimated cost \$100,000
- Que., Thetford Mines—Johnstone Ashestos, Ltd., Thetford Mines, plans to construct a 1 story, 40x300 ft, warehouse. Estimated cost 565,000.

### Contracts Awarded

- Ala, Sheffield—Electro Metallurgical Co., Niagara Falis, N. Y., has awarded the contract for an addition to its plant to C. G. Kershaw Contracting Co., 2212–20th Ave., S. Birmingham. Estimated cost will exceed \$68,000.
- Ask. North Little Rock—Visking Corp., 1200 East 5th 5t., manufacturer of cellulose sassage casings and other cellulose and plastic products, has awarded the contract

- Current Projects Complative 1949. Proposed Proposed. Work Work Contracts \$342,000 \$1,460,000 868 000 \$200,000 New England 387,000 158,633,000 15,532,000 Middle Atlantic 300.000 SS TERM 9.319.000 31, 313, 000 780,000 13,254,000 Middle West. 100.000 46,668,000 93,538,000 West of Missessippi 1.570.000 Far West. 140.000 7.495.000 61,861,000 51,333,000 60.903.000 Canada ... 20, 168, 000 223.000
- for an addition to its plant to Ditmars, Dickman & Pickens, Gazette Bldg. Estimated cost \$1,000,000.
- Calif., Newark—Westvaco Chemical Div., Food Machinery & Chemical Corp., Newark, has awarded the contract for a manufacturing plant to United Engineers & Constructors, Inc., Box 1189, Newark. Estimated cost will exceed 570,000.
- Calif., South San Francisco—E. I. du Pont de Nemours & Co., Inc., Linden Ave., and Wilmington, Del., has awarded the contract for warehouse alterations to Cabill Bros., 206 Sansonie St., San Francisco. Estimated cost \$70,000.
- Conn., West Hartford—Pittsburgh Plate Glass Co., 40 Chapel St., Hartford, lass awarded the contract for a 1 story. 1003/30 ft. wareliouse and office building to wadhams & May Co., 15 Lewis St., Hartford, at \$199,850.
- Del., North Clavmont—General Chemical Co., 40 Rector St., New York, N. Y., has awarded the contract for an addition to its manufacturing plant here to Thomas Earle & Sons, Land Title Bldg. Philadelphia. Estimated cost will exceed \$68,000.
- Ill., Chicago—Chicago Carton Co., 4200 South Pulsaki St., manufacturer of paper boxes, has awarded the contract for an addition to its plant to contain 100,000 sq. ft. floor space to Carl E. Erickson, 465° North Ravenswood St. Estimated cost \$700,000.
- III., Chicago—City Glass Co., 3018 Wahash St., Chicago, has awarded the contract for a glass processing plant to Rogin Construction Co., 1009 North Wells St., Chicago. Estimated cost \$90,000.
- Md., Baltimore—F. S. Rovster Guano Co., Rovster Bldg., Norfolk, Va., has awarded the contract for a fertilizer building at 2001 Chesapeake Ave., Fairfield to D. J. Rose & Son, Rocky Mount, N. C. Estimated cost \$100,000
- Md. Baltimore—Procter & Gamble Co., Gwynne Bldg, Cincinnati, O., has awarded the contract for the construction of a light manufacturing building at Locust Point to H. K. Ferguson Co., 1783 East 11th St., Cleveland, O., at 569,495.
- Mo., St. Louis—Mallinckrodt Chemical Works, 3600 North 2nd St., has awarded the contract for a 1 story, 83x123 ft, water house for chemical plant at 64 Destreban St., to Dickie Construction Co., \$20 Louderman Bldg, Estimated cost \$70,000.
- Pa., Philadelphia—Globe Solventy Co., "th and Fishers Ave., has awarded the contract for the construction of a factory to Keystone Construction Co., 1239 Unruh St. Estimated cost \$150,000.

Fex., Abilene—Patton Oil Refinery, Abilene, has awarded the contract for reconstructing its refinery to J. McWilliams & Co., Sweet water. Estimated cost 592,000.

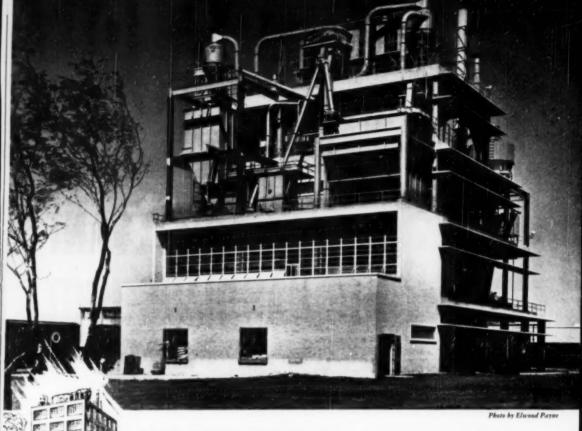
\$25,431,000 \$23,790,000 \$287,044,000 \$297,477,009

- Tex., Gainesville—Southland Naval Stores Plant, Gainesville, manufacturer of paint thinners, will reconstruct its plant here. Work will be done by owners. Estimated cost \$75,000.
- Tex., Galveston—Stanolind Oil & Gas Co., Gulf Bldg., Houston, will construct a warehouse. Work will be done by owners. Estimated cost 575,000.
- Tex., Houston—Lone Star Cement Co., 402 Concrete St., has awarded the contract for an addition to its plant to Peterson Bros., 2301 North Wayside Dr. Estimated cost 570,000.
- Tex., Kenedy—Archer-Daniely Midland Co., Kenedy, has awarded the contract for the construction of a linseed oil refinery to S. E. Newman, Kenedy. Estimated cost \$75,000.
- Fex., Midland—Pittsburgh Plate Glass Co., c/o T. Jackson, Dallas, has awarded the contract for a plant and sloop to T. C. Bateson Construction Co., 622 Irwin Keasler Bldg., Dallas, at 5119,600.
- Tex., Por Mansfield—Pure Oil Co., Beaumont, will consume a warehouse here. Work will be done by owners. Estimated cost \$100,000.
- Tex., Sherman—Lone Star Gas Co., 1915 Wood St., Dallas, will remodel its warehouse. Work will be done with own forces. Fstimated cost \$75,000.
- 1ex., Victoria—E. I. du Pont de Nemours & Co., Inc., LaPorte, Tex., and Wilmington, Del., will construct 9 plant buildings for the manufacture of nylon chemicals on a 170 acre site on the Guadalupe River, also four service buildings. Work will be done by purchase and hire under supervision of T. F. Pierce, field project manager. Estimated cost 516,500,000 and \$52,750,000 respectively.
- Utah, Salt Lake City—Salt Lake Refining Co., North Salt Lake City, has awarded the contract for a catalytice cracking plant to Bechtel Corp. of California, 222 Bush St., San Francisco, Calif. This is part of \$10,000,000 expansion program planned by company.
- Alta, Hanna—Chloro Gas Products, Inc., Long Beach, Calif., has awarded the contract for the construction of a plant to Hanna Petroleum, Ltd., Hanna. Estimated cost 5150,000.
- Out., Samua—Imperial Oil, Ltd., 445 North Christina St., has awarded the contract for a 2 story addition to its grease plant to Samia Bridge Co., Ltd., 251 Campbell St. Estimated cost \$73,000.

-

EQUIT

CHEM



### GONE WITH THE WIND ... the drag on Profits

In direct contrast with the conventional closed type food processing plant, the Ferguson-engineered "open" type, illustrated above, breathes away the destructive gases that attack plant structure and personnel, constitute a fire hazard due to dust collection, and stifle profits. • This is typical of all Ferguson-engineered jobs . . . for Ferguson, with a process engineering background of over a quarter century of experience, makes the structure and

a process engineering background of over a quarter century of experience, makes the structure an integral part of the process . . . a working machine that supports but does not stifle profitable operation. • It invariably follows that there is lower capital investment, lower maintenance and

replacement cost, lower cost for personnel comfort and safety...all of which contribute greatly to the profit margin. So, too, this close approach to pure industrial architecture possesses the natural beauty that accompanies simplicity. • Our nearest office will gladly furnish you with current cost data on processing, research, manufacturing, warehousing, or power facilities.

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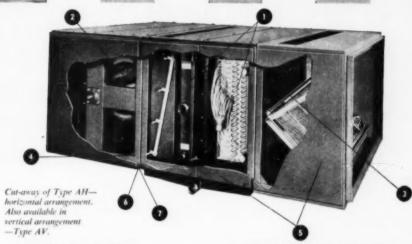


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with a revolutionary fan design. Non-overloading horsepower, steep stable pressure characteristic, certified performance.

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-static pressure requirements kept low. Ample filter area, plate-type fins, eddy-free flow.

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Sectionalized casing with welded, gussetted structural angle frames and insulated panels.

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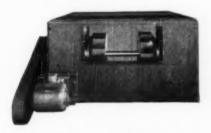
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PRECIPITRON 9 (Electronic Air Cleaner)



Surface Dehumidiflers

## "Don't send a boy to



There's a Powell Valve\* that's just right for every known FLOW CONTROL SERVICE

Fig. 560 – 200-pound Bronze Regrinding Horizontal Swing Check Valve with screwed ends, screwed-en cap and regrindable, renewable bronze disc.





Fig. 150 — 150-pound Bronze Globe Valve with screwed ends, union bonnet and renewable composition disc.



Fig. 1837 — 200-pound Nickel Globe Valve with screwed ends, union bonnet and inside screw stem. Made with botted bonnet in sizes 21<sub>2</sub>\* and 3\*.



Fig. 1828 — 200-pound Monei Metal Gate Valve with screwed ends, screwed-in bonnet and inside screw rising stem.

POWELL

## do a man's work"...

Most valve failures are the result of misapplication . . . installing valves that aren't of the right design or sturdy enough to do the job for which they are selected. In other words, it's like "sending a boy to do a man's work."

On the other hand, it's a waste of money to specify costly valves for services where less expensive ones may be used. This amounts to putting a man on a job that a boy can do.

To avoid misapplication: (1) standardize on Powell Valves; (2) consult Powell Engineers as to which valves are specifically adapted to each and everyone of your individual flow control requirements.

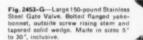
Powell makes such a complete Line\* that there is a Powell Valve exactly suited to every existing service, from the simplest to the most specialized or exacting. Ask your nearest Distributor—or write direct.



Fig. 500 — 125-pound Bronze Gate Valve with screwed ends, screwed-in bonnet, inside screw rising stem and tapered wedge; solid in sizes ½" to ¾"; double in sizes 1" to 3".

BOOTH 54

22nd Exposition of Chemical Industries Grand Central Palace, New York City Nov. 28 to Dec. 3, 1949



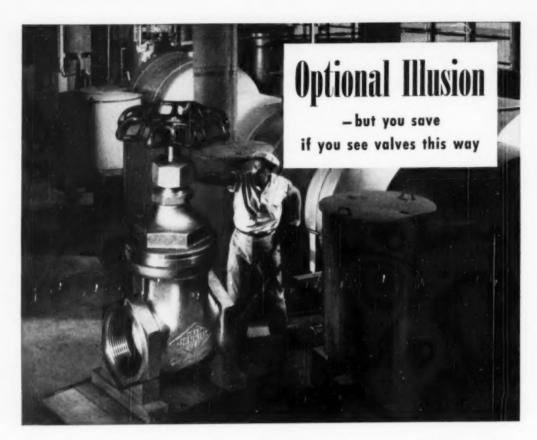


\* Powell Valves are made in Bronze, Iron, Steel and a wide selection of Corrosion-Resistant metals and alloys. Valves of every type— Globe, Angle, Gate, Check, Non-return and Flush Bottom Tank Valves—are included in the Complete Powell Line.

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VALVES



THERE ARE TWO WAYS OF regarding the valves in your plant. You can think of the relatively small cost of a single valve, and dismiss them as a minor, "petty cash" investment. Or, you can think of all valves in your plant as one valve, as pictured, by photo-magic, in this pharmaceutical plant,—and see them in proper perspective.

YOU'LL FIND IT PAYS to take the latter view, for in any plant, any building where fluid control is involved, valves, collectively, are as important, in terms of investment and operating expense, as larger plant units, and should be selected with the same sharp eye to quality and economy.

EXCESSIVE MAINTENANCE of one inferior valve is insignificant, but multiplied by thousands, it is a serious drain on operating budgets. JENKINS BROS. helps you meet this problem two ways. First, by building extra endurance into Jenkins Valves, making them the longest-lasting, lowest-upkeep valves that money can buy. See-

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## MUDDLING in High Places

It is time for men in Washington and London to stop toying with the problem of international trade. We of the democratic West are at a turning point in our economic affairs. A false step by either the United States or Britain could lead quickly to disintegration of trading between the people of the world as we have known it for the past hundred years. Recent meetings of diplomats in London and Washington have not lifted us out of this danger.

By two simple tests you and I can measure the sincerity of the men in Washington and in London who are trying to solve what they call "the dollar crisis."

One test applies to the British: Is Britain making an honest effort to re-establish itself as a real competitor in world markets?

The other test applies to us in the United States: Are we willing to see Britain re-emerge as a strong competitor in world markets—even in our own home market—and to help her do so?

Today, even though both countries have faced the devaluation test, the answer to these questions probably is no.

### T

The situation we face is, in fact, unprecedented. In every important industrial country of the non-Communist world, except Germany and Japan, production is above prewar volume, thanks largely to the Marshall Plan. Yet trade between nations is shackled as it has never been since the 18th century. And the shackles grow day by day. What is worse, two distinct trading areas—the dollar area and the

sterling area - have grown up in the non-Communist world, and the gulf between them grows wider.

What kind of leadership have the United States and Britain had in the face of this crisis? President Truman late in August wisely checked the trans-Atlantic bickering over the dollar crisis. But Mr. Truman showed no awareness of the basic question that the American people must soon decide: Is the United States able and willing to generate trade between nations, as Britain did in the 19th century?

What have British leaders offered us? Foreign Secretary Bevin and Chancellor Cripps called their September visit to Washington "one of the most important missions in history." But they did not tell the British people, and perhaps do not admit themselves, that their Labor government must change its internal and external policies if Britain is ever to earn its living in a competitive world.

Admittedly, the problem Britain has faced since 1945 is a colossal one. But, in the face of its grave difficulties, what has Britain done? The working day was shortened. Welfare economics have run riot. High taxes have sapped incentives. Labor and capital have clung to their prewar psychology of cartels and featherbedding. Government controls and government trading have hamstrung private initiative. Nationalization schemes have injected politics into the struggle for industrial recovery.

Thus the policies of the Labor government have made Britain's adjustment to its new position in the world immensely more difficult. But Americans who attribute the danger of an international breakdown to British socialism greatly oversimplify the problem. Virtually every country in the world, socialist or not, faces the same dollar crisis that Britain faces.

continued on next page

We Americans must recognize that our economic strength unbalances world trade as does Britain's weakness. World War II increased America's superior power to produce goods. It also made the United States more self-sufficient. Thus, while the world demand for American goods has risen, our demand for foreign goods, except for basic raw materials, has not increased. Today we sell more to every major area of the world than we buy from it—and yet we wonder why there is a dollar crisis.

It is time for us to recognize that there are two fundamentally conflicting pressures at work in the United States. One is our desire for a big surplus of exports over imports. The other is our desire for a system of free-wheeling trade around the world. We can not have both unless we as taxpayers wish to subsidize our exports. Which do we want?

Curtis E. Calder, chairman of the International Relations Committee of the National Association of Manufacturers, says, "The battle of the foreign trade gap is essentially that of reconciling our urge to export our surpluses with a reluctance to accept imports in payment for them . . . The dilemma is an uncomfortable one to face."

### II

Here, then, are the basic questions that confront men in Washington and London. Does Britain really want expanding world trade or a high-cost welfare state? Does the United States really want expanding world trade or a huge surplus of exports? So far politicians in Washington and especially in London have ducked these issues because they are political dynamite.

If the people of Britain decide they want to regain their position as a competitive trader in expanding world markets, here are specific objectives that men in London should set for themselves;

1. Lower government costs. The British Treasury has asked for cuts of 5% in 1950. But a cut nearer 15% will be necessary, even if that means fewer government subsidies and health services. Enterprise will never revive nor costs come down while taxes take 40% of the British national income, including roughly 60% of business profits.

 Fewer government controls. Only by removing controls and allocations (except on a few necessities) can Britain begin to return to prices fixed by competition rather than by government fiat.

3. Stronger anti-monopoly legislation for both business and labor. Britain needs a concerted drive

against all forms of restrictive, high-cost practices. This drive should put teeth in the anti-monopoly act and supplement it with legislation to end restrictions imposed by trade unions.

4. Less restrictive trading practices. Britain should retreat gradually from its international barter between governments if competition is ever to have free play in international trade.

Meanwhile, if we of the United States sincerely want multilateral world trade, men in Washington must face up to four problems and hammer out workable solutions:

 Use of the International Monetary Fund to back a devalued pound. In time the Fund, in which we have the controlling voice, might be used to promote convertibility of pounds into dollars.

2. Help for Britain in meeting war-created external debts. This might mean support for London in getting a reduction of the war debts Britain owes India, Pakistan and Egypt, for example. To achieve such a debt reduction for Britain we might have to underwrite a part of a Southeast Asia recovery program.

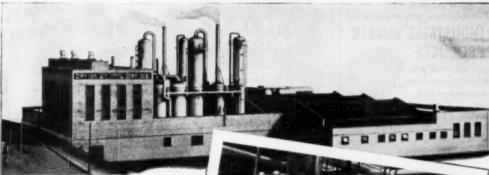
3. Encouragement of American investments abroad. Such investments should be directed primarily into enterprises which will earn dollars, such as the development of new sources of raw materials, or which will raise productivity abroad.

4. Our own tariff barriers. Our attitude toward this critical issue will be the acid test of how deeply we believe in the merits of free world competition.

If we really want free, competitive trading between the people of the world, these issues must be met and resolved by leaders on both sides of the Atlantic. If we do not want to face these issues, then let us resign ourselves to a world walled off into three trading areas: the Communist bloc, the sterling area, and the dollar area. So far, Washington and London have muddled along, except in facing the devaluation problem. Clarity and courage are still needed.

Same H. W. haw. N.

President, McGraw-Hill Publishing Company, Inc.



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   inter parts can les-later parts can les-
- latex parts can lam-prove product design
   to work and use hard rubber
- o to engineer and in-stull V-best drives types of rubber hose for best service
- of to select rubber for bear subber can inlings to withstand eletho-out rubber can reduce costs

### SEE IT 10 DAYS' FREE

McGraw-Hill Book Co., Inc., 330 W. 42 St., NYC 18 Send me a copy of Buston's ENGINEERING WITH RUSSER for 10 days' examination on ap-proval. In 10 days I will remit \$6.50, plus few sents delivery charges, or return book postpaid.\* City "HAVE! We pay mailing costs if you send cash with this coupen. Same return privilege.

### **BUILT TO TAKE** PUNISHMENT INTERSTATE TRANSPORTATION

### HERCULES

(RUBBER CUSHIONED) HERCULES (CORK CUSHIONED)

### CARBOY BOXES

AVAILABLE in 5 and 13 gallon sizes to comply with specification ICC 1-A.

Available in 61/2 gallon size to comply with specification ICC 1-D.



HOME OF HERCULES CARBOY BOXES . NEWARK S, N. J



### MAILING LISTS THAT

WORK

McGraw-Hill Industrial Mailing Lists are a direct stude to today's purchase-controlling executives and tech-nicians in practically every major industry.

These names are of particular value now when most manufacturers are experiencing constantly increasing difficulty in maintaining their own lists.

Probably no other organization is as well equipped as McGraw-Bill to solve the complicated problem of list maintenance during this period of unparalleled changes in industrial personnel. These hists are compiled from exclusive sources, based on hundreds of thousands of mail questionnaires and the reports of a nation-wide field staff, and are maintained on a twenty-four hour hunts.

Investigate their tremendous possibilities in relation to your own product or service. Your specifications are our quide in recommending the particular McGraw-Bill lists that best cover your markst. When planning your industrial advertising and sales promotional acadeties, ask for more facts or, better still, write today. No obligation, of course.

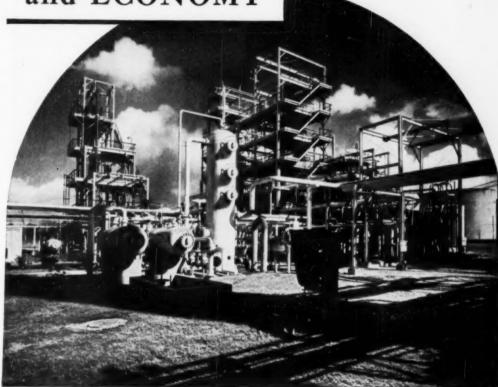
### McGraw-Hill Publishing Co., Inc.

DIRECT MAIL DIVISION

630 West 42nd S.reet

New York, 18, N. Y.

EFFICIENCY and ECONOMY



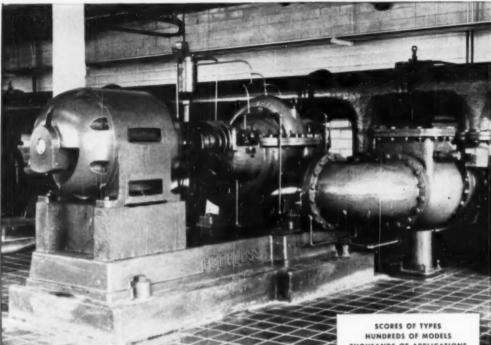
N the planning and execution of expansion programs, Stone & Webster Engineering Corporation offers to industrial organizations the efficiency and economy resulting from a competent and coordinated engineering and construction staff with broad experience in all phases of design and construction.



STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

### PEERLESS HORIZONTAL CENTRIFUGAL PUMPS



### For continuous or intermittent duty in a host of diversified services

Select the pump you need for the process you use from the diversified line of Peerless horizontal pumps. The pump shown above, a Peerless general purpose pump handling plant process water, typifies a host of efficient Peerless centrifugal pumps which are boosting output and cutting costs for manufacturers and municipalities everywhere. With its comprehensive line of horizontal pumps Peerless can handle chemicals or alkaline liquids, pump clear water or solids in suspension. There are pumps for fluids at high temperatures or they can furnish water or foam for approved plant fire protection. Peerless will move volatile

butane-propane or tricky caustics and acids. Pumps are available for all practicable heads and capacities. Duty can be continuous or intermittent. Construction materials are suited to the liquid being pumped. And, backing up their installation qualified Peerless field engineering service is available in all principal cities to see that each pump matches or exceeds customer expectations. Write today for pump engineering information on your process or service. The chart at right lists a number of the types of Peerless horizontal centrifugal pump bulletins in which you will be interested.

### PEERLESS PUMP DIVISION

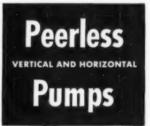
FOOD MACHINERY AND CHEMICAL CORPORATION Los Angeles, California Indianapolis, Indiana

District Offices: New York 5, 37 Wall St., Chicago 40, 4554 N. Broadway; St. Louis 8, 3908 Olive St., Atlanta Office: Rutland Bldg., Decatur, Ga.; Omaha, Nebr., 4330 Leavenworth St.; Dollas 1, Tex., 3905 Elm St.; Fresna, Calif.; Los Angeles 31, Calif.

### THOUSANDS OF APPLICATIONS

Here are a few of the services which Peerless horizontal pumps can per-form. Plan with Peerless. Request copies of the Bulletins you need by

| Pump Service       | Bullstin No |  |
|--------------------|-------------|--|
| Water Supply       | B-1300      |  |
| Fire Protection    | 8-1500      |  |
| Chemicals and Oils | B-810       |  |
| Vaporous Liquids   | 8-2201      |  |
| Butane-Propane     | B-2200      |  |
| Boiler Feed        | 8 856       |  |
| Sewage and Solids  | B-154       |  |
| Ni-Pressure        | B-310       |  |
| Acids and Caustics | D-2400      |  |
| Process Services   | 8-803       |  |
| All-nurness Pumps  | 8.2301      |  |





## The NEW STERLING\* MODEL STAINLESS STEEL LIXATOR\*

### Brings Maximum Efficiency at Lower Cost to Brine Production

The Stainless Steel Sterling Model Lixator is the last word in brine production. This model Lixator provides added money-saving improvements that mean still lower brine production costs.

Stainless Steel Construction for "Lifetime" Use

**Improved Cleanout System** 

Lowered Storage Hopper for Easier Filling

Added Cleanliness

The Sterling Model Lixator is manufactured in standard sizes ranging in capacity from 50 to 425 gallons of brine per hour.

Why not consult us about your brine problems? The specialists in our Technical Service Department are available for free consultation. These experienced men will advise you on the proper location for Lixator and salt storage, pumping arrangements, types of pumps, meters and valves. They will show you how the new Sterling Model stainless steel Lixator means bigger profits for you. Write today!

OVERHEAD FEED CHUTE FOR LIXATOR WITHOUT HOPPER STERLING\*MODEL HOPPER FOR EASY FILLING STERLING SALT STORAGE FLOAT SALT DISSOLUTION ZONE FLUSHING WATER SALT NO7ZLES FILTRATION ZONE FEED

### WHAT THE LIXATOR PROVIDES

Chemical and bacterial purity to meet the most exacting standards for brine.

Unvarying salt content of 2.65 pounds per gallon of brine. Crystal-clear brine.

Continuous supply of brine.

Automatic salt and water feed to Lixator.

Inexpensive, rapid distribution of brine to points of use by pump and piping.

### PLUS THESE PRODUCTION SAVINGS

- Ends havling salt around the plant.
- Saves time wasted in making brine.
- Stops waste of salt by spilling.
- Assures accurate salt measurement.



for making brine

INTERNATIONAL SALT COMPANY, INC.
Scranton, Pa.

\*Trade Mark

CHEMICAL ENGINEERING-October 1949

### BAKER Baker platinum laboratory ware is made under the direct supervision of scientific men who use it daily in our own laboratories. No better controlled manufacturing conditions could be devised for the production of apparatus with the metallurgical and mechanical precision required for scientific use. The natural result is that Baker laboratory ware is continuously under test and as improvements have suggested themselves, they have been made. Instances are the introduction of platinum-rhodium for this ware, our reinforced rim crucibles and dishes, the Baker Low Form crucible and the reinforcement of the junction of stem and cylinder in stationary type electrodes. Our Data Concerning Platinum contains a catalogue of Baker laboratory ware as well as useful tables and other valuable information. Send for a copy. BAKER & CO., INC. 113 Astor St., Newark 5, N. J. San Francisco 2



### POLYTHENE-LINED PAPER BAG PROTECTS MOISTURE-SENSITIVE GLUE

Multiwall bag with a polythene-coated ply has improved resistance to atmospheric moisture over a wide range of temperatures...plus many other advantages

When The Borden Company needed an economical, damp-proof package for a very hygroscopic powdered resin glue, they chose a sturdy, lightweight, inexpensive multiwall paper bag, one layer of which has a thin coating of Du Pont polythene plastic. These bags keep moisture out during handling and shipping, protect contents until used. Compared with many other types of containers, the empty bags save up to 91 % of storage space—save shipping costs, too.

The use of paper coated with Du Pont polythene in multiwall bags provides these advantages:

- better protection against moisture
- better chemical resistance
- · better strength
- better grease resistance

These characteristics are retained over a wide range of temperatures. The use of a polythene-coated ply also offers greater versatility, since film thickness can be varied to meet specific requirements.

Many other "hard-to-pack" products are being successfully shipped in these bags, including calcium chloride, dry milk, meat trimmings, sodium bisulfite, benzene hexachloride, quicklime, various synthetic resins.

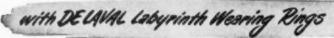
various synthetic resins.

The multiwall bag is only one of many new packaging applications of polythene. The new coating technique used here is a joint development of St. Regis and Du Pont technical men. Du Pont representatives will gladly work with extruders, molders, or converters, or will suggest suppliers who can meet specific needs for packaging or other uses of plastics. Write today for free literature on polythene and other versatile Du Pont plastics.

(Multiwall hag made by St. Regis Paper Co., New York, New York.) E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Main Sales Offices: 350 Fifth Ave., New York 1, New York; 7 S. Dearborn St., Chicago 3, Illinois; 845 E. 60th St., Los Angeles 1, California.



every year the power savings grow greater







### Here's the reason why

Assume that two pumps attain the same efficiency when new. One is equipped with ordinary close clearance, flat rings at the running joint between impeller and casing; the other with large clearance labyrinth rings.

As wear increases the clearance between the rings, the efficiency of the pump equipped with flat rings drops off more rapidly than that of the labyrinth ring pump because the flow retarding action of the flat rings depends solely upon the maintenance of close clearances; while the flow retarding action of the labyrinth rings is due to the resistance of a labyrinth passage.

The longer the pumps are used, the greater the difference in leakage, the greater the difference in efficiency and the greater the saving due to the use of De Laval labyrinth wearing rings. Every year the power savings grow greater

When selecting a pump consult the rating tables in De Laval Catalog 10-15-M.



### DE LAVAL STEAM TURBINE COMPANY, TRENTON 2, N. J.

TURBINES . HELICAL GEARS . CENTRIFUGAL BLOWERS AND COMPRESSORS
CENTRIFUGAL PUMPS . WORM GEAR SPEED REDUCERS . IMO OIL PUMPS

10-15

## their LONG LIFE makes LAPP PORCELAIN RASCHIG RINGS

the most economical tower packing you can buy

HE cost of packing for chemical towers must be based on original cost of the packing against length of service, plus labor cost for cleaning and repacking, and lost production time. Because they are stronger and smoother, Lapp Porcelain Raschig Rings last longer . . . they are the most economical ceramic rings you can buy.

STRONGER, NON-POROUS PORCELAIN. Lapp Raschig Rings are made of solid Lapp Chemical Porcelain, a dense, thoroughly vitrified, pure, iron-free ceramic material of zero porosity... permits no absorption of liquids so avoids disintegration and crumbling.

SMOOTHER SURFACE. Without benefit of glazing, Lapp Porcelain is hard and smooth, easy to clean—and stays clean longer.

Lapp Rings are available in 3%, 12, 5%, 34, 1, 114, 114, 112, 2" and 3" sizes. Write for detailed description, prices, samples. Lapp Insulator Company, Inc., Process

Equipment Div., 110 Maple St., LeRoy, N. Y.

Lapp

PROCESS EQUIPMENT

HEMICAL PORCELAIN VALVES . PIPE . RASCHIG RINGS PULSAFEEDER CHEMICAL PROPORTIONING PUMPS

## Does <u>your</u> advertising manager rate an invitation to the management table?

I F YOU SHOULD ASK him, he'd probably say "yes." And his reasoning might run something like this:

Management's first responsibility is to show a fair profit. This requires a relentless search for continued improvement—in design, in purchasing, in production, research and cost-accounting. Each deserves its place at the management table. Yet none of these activities can actually create a dollar of profit, for the simple reason that you can't produce anything at a profit—not unless you can also sell it.

And that's what makes the advertising manager's job so important,

His first responsibility is to see that your company's products are made familiar (and desirable) to the greatest number of prospects, at the lowest possible cost. In fulfilling this responsibility, he sets a parallel course with the sales department, although his approach more closely resembles that of the assembly line technician.

For advertising, as he sees it, is simply the application of assembly line techniques to the manufacture of a sale. Just consider the five basic steps involved:

- 1. Seeking out prospects
- 2. Arousing their interest
- 3. Creating a preference for your product
- 4. Making a specific proposal
- 5. Closing the order

By mechanizing the first three of those steps, advertising increases management's chance to show a profit. It leaves your salesmen free to concentrate on the two jobs which they alone can do, and do best.

And nowhere does this mechanizing process operate more efficiently than in the business press, where it reaches your best prospects at the lowest possible cost.

Perhaps that's why so many smart advertising managers are partial to business paper advertising—and why more of them, incidentally, are getting to sit at the management table!

October 1949—CHEMICAL ENGINEERING

### CHEMICAL ENGINEERING

With Chemical & Metallurgical Engineering
A McGraw-Hill Publication

330 West 42nd Street

New York 18, New York



### THE ASSOCIATED BUSINESS PAPERS

205 East 42nd Street, New York 17, N. Y.

ABP's BUSINESS IS TO BOOST YOUR BUSINESS

### LEAD

### LINED EQUIPMENT

curbs Corrosive Acids



The "vessels" used in the process industries may range from a five-gallon receptacle to a cavernous tank. Details of construction may differ. But, when it comes to handling corrosive chemicals, much of this equipment has at least one thing in common... a lining of lead. Because Lead blunts the teeth of hungry acids.



Leaders in the chemical processing field have something in common, too. They rely on the leader in lead products...

National Lead... for their lead-lined and lead-covered equipment. They know that National offers... and delivers... not merely a mass of metal bearing outward resemblance to drawing and blueprint, but a piece of acid-handling apparatus that has the built-in ability to do the job it was bought to do. Into each unit goes the know-how, from drafting board to shop assembly, that makes the most of lead's resistance to chemical attack plus steel's resistance to physical abuse.



In National Lead's "Homogeneous" lead-lined tanks, drums, agitators, autoclaves and other items of this nature, the lead lining is bonded directly to the steel casing. An inseparable bond is created, a union of lead and steel that obviously will withstand higher temperatures than one in which solder is used.



Every piece of National Lead's "Homogeneous" lead-lined and lead-covered equipment is individually fabricated to your specifications. When you want information on acid-handling apparatus, please consider our specialists in this field at your service.



## Look to the Leader for Lead

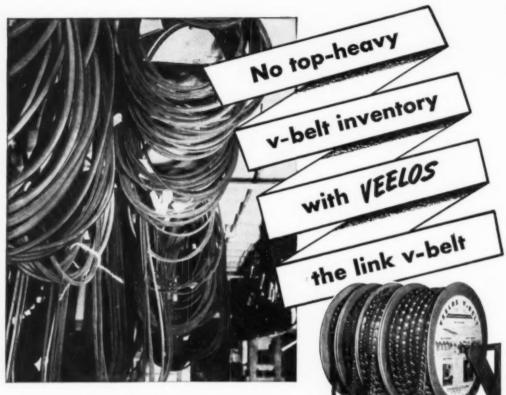
...in everything from lead pipe...valves...sheet...and lead-lined or lead-covered equipment...to complete acid recovery plants

### NATIONAL



**Lead Company** 

New York 6; Baltimore 3; Bufiale 3; Chicago 8; Ciacionati 3; Cloveland 13; Pittsburgh 12; St. Louis 1; Boston 6 (National Lead Company of Mass.); Loc Angeles 22 (Maris P. Kurk & Son, Inc.); Philadelphia 25 (John T. Lewis & Rons. Co.); Atlanta (Georgio Lead Works, Div. of Cincinnati Branch); Toronto, Canada (Canada Mesal Ca. Ltd.).



### 4 reels of VEELOS <u>replace</u> 316 sizes of endless v-belts

• Why jam your stockroom with costly inventories of hundreds of sizes of endless v-belts when 4 reels of VEELOS will handle every v-belt job in the O, A, B and C widths? If you use only two widths of v-belts, two reels of VEELOS will be all you need.

It's a matter of record that dollar for dollar VEELOS gives the greatest value. Machine maintenance is kept low because uniform tension is easy to maintain. You install VEELOS without dismantling outboard bearings.

### PUT THESE 7 VEELOS EXTRAS TO WORK FOR YOU...

- Minimum Inventory
- Easy Installation
- Any Length Immediately Available
- Practically No Downtime
- Smooth, Vibrationless Power Delivery
- Long Lasting
- Matched Belts That Stay Matched



For All the Focts and complete engineering information, measuring and installation directions write for your copy of the Veelos Data Book.

MANREIM MANUFACTURING & BELTING COMPANY
MANHEIM, PA.



### ADJUSTABLE TO ANY LENGTH . ADAPTABLE TO ANY DRIVE

Made in all standard sizes, fits all standard grooves. Packaged on reets in 100-foot lengths. Sales engineers in principal cities; over 350 distributors throughout the country. Veelos is known as VEELINK outside the United States.

# could save you \$5,000 (HONESTLY)

This is no trick headline. It's the gospel truth. The essence of the message, we may as well tell you right at the outset, has to do with early consideration of drying equipment and the availability of Proctor engineers to assist you without cost or obligation in conducting drying research.

So many process engineers have found out the hard way, that people like Proctor & Schwartz, were not fooling when they have said over and over and over again—(1) early consideration of a drying problem pays off in cash—and (2) the services of Proctor laboratories are available to you without cost or obligation from the moment you begin considering a process that involves drying—up until it is proven that Proctor & Schwartz can supply you with the right equipment or that some other drying process should be used.

Proctor engineers are more interested in helping you solve your problem... more concerned with saving you money and effort than with selling equipment. Of course, they want to sell equipment—that's the ultimate aim of any equipment manufacturer. However, the right solution to your problem may be to refer you to a manufacturer of an entirely different type of drying equipment from the atmospheric type manufactured by Proctor & Schwartz. If that is borne out by research—that is what Proctor engineers will do—and the research will still not cost you one red cent.

The one thing we do want you to believe and act upon is this matter of early consideration of your problem. We have had actual experience with manufacturers who have gone so far as to order most of the other equipment in their processing line before considering drying equipment. The results in some cases have been pathetic, really. Sometimes the drying equipment has cost far more than it should if the preliminary processing had been handled differently... on other occasions costly alterations had to be made to equipment already installed.

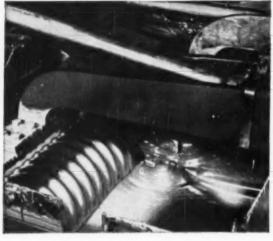
In every instance, such expensive pitfalls could have been avoided had the manufacturer taken us into the picture early enough and availed himself of our free research facilities.

When you are planning a processing line you aren't playing with peanuts . . . \$5,000 or \$10,000 may well be saved by a sensible approach. We aren't trying for inquiries . . . we're trying to save you money. If you are engaged in planning a process that involves drying—take us into your confidence without delay for your own good.

PROCTOR & SCHWARTZ, INC.
711 TABOR ROAD
PHILA. 20, PA. • Michigan 4-6400

### the mechanical giant with the sweet

Close-up of one of the 56 pats filled with liquid chocolate in the unique "conche."



### LONGER, EASIER ON SIGE

Rockwood & Company, one of the "Big Four" of chocolate manufacturing and blending in the U. S., blends and mixes with a giant machine called the "conche." And the ADSIP Ball and Roller Bearings on the 90 rolling parts aids to provide outstanding performance.

Since the installation of the "conche" in 1933, it has been mixing chocolate around the clock in a room heated to 105 degrees. Yet, attesting to the remarkable endurance of BDSP Bearings, 98% of the original bearings are still in service! 500,000,000 pounds of chocolate blended . . . on BDSP Ball and Roller Bearings.

This is just one example of the work BDSF Bearings are doing . . . and doing well. They are preferred by manufacturers of cream separators, dough mixers, sugar beet machinery, fishing and canning machinery for foods and fertilizers—presses, driers, extruders, beverage bottling machinery . . . wherever a shaft turns in food processing machinery, that's the place for BDSF. And there's an BDSF Bearing to meet every requirement. Our engineers can help. BDSF Industries, Inc., Philadelphia 32, Pa. 6366

tooth . . .

mixes

mixes

mixes

mixes

mixes

mixes

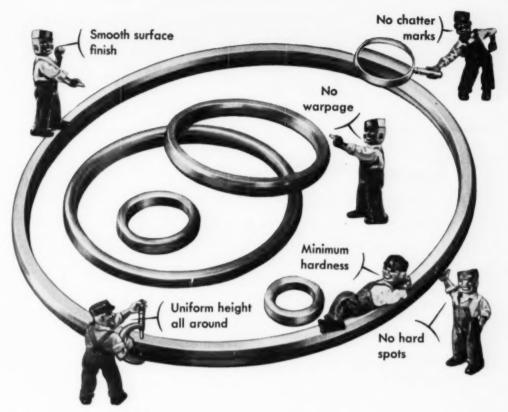
### BALL AND ROLLER BEARINGS



SKF







## Made "soft" for proper flow ... Made accurate for perfect fit!

### Goetze V-Tite Gaskets for ring-type joint flanges

One sure way to tell quality in a gasket designed for ring-joint flanges is to check the hardness. In Goetze V-Tites, carefully controlled heat treatment during fabrication keeps hardness down to a minimum. The hardness of a Goetze soft iron V-Tite Gasket, for example, does not exceed 90 Brinell.

And because each gasket is uniformly "soft" throughout (you'll find no hard

spots in a Goetze V-Tite), proper flow or seating of the gasket, without damage to flange surfaces and with minimum bolt stresses, is always assured.

Dimensional accuracy is also important in a ring-type gasket. Here, too, Goetze V-Tites meet high precision standards. They are of uniform height all around... free of warpage... have the same centerto-center measurements top and bottom ... other tolerances are well within API and ASA specifications to assure a perfect fit in the flange grooves.

In addition to soft iron, Goetze V-Tite Gaskets are made in a number of alloys in all standard ASA and API shapes and sizes. Gaskets of special dimensions are also available. For further details, write for Catalog PK-35A. Johns-Manville, Box 290, New York 16, N. Y.



Johns-Manville *Goetze* Gaskets

THERE'S A JOHNS-MANVILLE PACKING OR GASKET FOR EVERY SERVICE

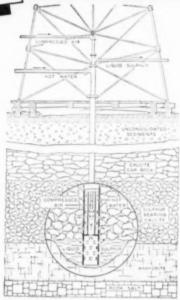
## SULPHUR

\*Interesting Facts Concerning This Basic Raw Material from the Gulf Coast Region

### \*WELL PIPING

The well equipment consists of pipes of various sizes, placed one within the other and extending from the surface into the sulphur deposit. A 10" or an 8" casing extends to and rests on the top of the cap rock. A 6" pipe, inside the casing, passes below it and reaches into the barren anhydrite. It is perforated at two different levels, separated by an annular collar. The upper set of perforations permits the hot water to enter the sulphur formation and the lower set permits the entrance of the molten sulphur to the discharge pipe fitted inside the 6" pipe.

When a well is "steamed" the hot water passes down the annular space inside the 6" pipe and outside the sulphur pipe and flows through the upper set of perforations into the porous formation. The entire mass through which the hot water circulates is raised to a temperature above the melting point of sulphur. The liquid sulphur being heavier than water, makes its way downward to form a pool and displaces water around the foot of the well, and rises in the well column through the lower perforations into a 3" pipe which is the sulphur discharge pipe. Compressed air released at the bottom of still another pipe fitted inside the 3" pipe rises and mixes with the sulphur column, forming an air lift which raises the liquid sulphur free of water to the surface.



Loading operations at one of the huge vats of Sulphur at our Newgulf, Texas mine. Such mountains of Sulphur are constantly being built at our mines, from which shipments are continually made.



TEXAS GULF SULPHUR
75 East 45th St. New York 17, N. Y.
Mines: Newgulf and Moss Bluff, Texas

## NUR OWN Gentlemen: The first GRID Unit



Heaters were installed by heaters were installed by
us eight years ago. We
us eight years ago iron
have found the cast iron
construction stands up very
construction stands up fumes of HGL
against the corrosive fumes of against the corrosive fumes of HCl.
Cl2 etc., and as far as we know
there has not been any maintenance there has not been any maintenance on the units. The unit heater's having copper tubes gives trouble due to corrosion in a few years... We consider the GRID Unit Heaters and would certainly we consider the URID Unit Heaters satisfactory and would certainly recommend them for installation where corrosive acid fumes exist. A LARGE EASTERN CHEMICAL PLANT

## yoment

WILL STAND UP UNDER CONDITIONS PECULIAR TO THE CHEMICAL INDUSTRY

Not only do GRID Unit Heaters stand up against the corrosive fumes of HCl and Cl. but even in that service they are maintenance-free. Chemical plants that have used GRID Unit Heaters continuously since 1931 report "they have given us trouble-free heating service ever since the day they were installed," and this season they still did an efficient heating job. Why this long continuous service to the chemical industry

Ing job. Why this long continuous service to the chemical industry? GRID Unit Heaters are designed to eliminate maintenance... GRID heating sections are ONE piece construction high test cast iron of the same composition as is used in steam tight vessels for high pressures. That's why GRID Unit Heaters may be used safely on steam pressures up to 250 lbs. In GRID condenser "fin" sections there are no soldered, brazed, welded or expanded connections to become loose or develop brazed, wender of expanded contentions to technical contents of the leaks, breakdowns or heating failures . . . no electrolysis to cause corrosion that produces leaks, breakdowns and heating failures, because there are no dissimilar metals used in GRID construction.

GRID Unit Heaters are designed to save fuelcost, too, because they provide heat where it is most needed—
to the working zone. Careful selection of fans and motor speeds eliminates stratification of warm air at
ceiling level . . . GRID Unit Heaters are designed for low outlet temperatures and greater air delivery to
the floor line — not the ceiling . . . that's another reason why chemical
plants all over the country prefer GRID.



GRID cast iron "fin" sections are adaptable for use as radiators, either open or convector types.

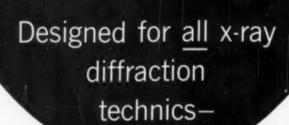
Investigate the GRID system for chemical plant heating. It's different and time-proved.



BLASTICONS

ONE CONSTRUCTION HEATING SECTIONS

CE) and GRID BLAST COILS



the XRD-3



THE NEW General Electric XRD-3 is the first complete diffraction unit. Here's what you can do with the basic XRD-3 and its components: (1) Measure diffracted intensities directly. (2) Measure fluorescent x-ray spectra directly. (3) Make use of all film technics.

ALL XRD cameras and many others fit the standard diffraction instrument support. Other cameras adapt simply to the clear, flat console top.

The XRD-3 is economical. There's no waste when you invest in the XRD-3. You get it as you want it. Start with the XRD-3F for film technics. And the SPG X-Ray Detector and SPG Spectrogoniometer as you need direct measurement technics.

The XRD-2 is occurete. X-ray intensity is constant to plus or minus  $\frac{1}{2}\%$ . An electronic voltage regulator keeps primary voltage at 0.2% of output voltage. An x-ray tube current

stabilizer checks tube current drift to 0.02% variation. The exposure timer is correct to within 60 seconds in a 20-hour range. Latched ma and high voltage positions reproduce settings accurately for long series of experiments.

The XRD-3 is efficient. X-ray intensity is high; the full-wave rectified transformer is rated at 50 kvp, 50 ma, with plenty of safety factor. The CA-7 tube and Geiger Counter tube are equipped with beryllium windows. A built-in water cooler saves cost of plumbing, assures long, efficient tube life. You work efficiently, too, at the deak-type console with meters, controls and indicators within easy reach.

FREE—The full facts are available on the first complete diffraction analysis unit—the XRD-3. Write General Electric X-Ray Corporation, Dept. J.5, 4855 Electric Avenue, Milwanke 15. Wise.

GENERAL & ELECTRIC
X-RAY CORPORATION

General Electric X-Ray Corporation manufactures and distributes x-ray apparatus for industrial, dental and medical use; electromedical apparatus; x-ray and electromedical supplies and occessories.

Baldwin-Hill

MONO-BLOCK

... the one-block /insulation

made with

BLACK

**ROCK WOOL** 

effective to

1700°F

Send for free copy of our catalog "Industrial Insulation" which describes 8-H MONO-BLOCK and other Baldwin-Hill Insulations. Baldwin-Hill Company, 701 Breunig Ave., Trenton, N. J.

Nome\_\_\_\_\_Pr

drass

## What's so glamorous about advertising?

THERE IS A curious belief in some quarters that advertising lives in a glamorous and almost occult world of its own, quite insulated against the cold science of the production line.

That, of course, is pure Hollywood.

Advertising today (in the business press, at least) is about as glamorous as a drop forge, and twice as efficient. It can become just as important to your profit-and-loss picture as plant maintenance, safety engineering, production techniques or cost-accounting. Maybe even a little more so.

Because the biggest plant capacity, and the best production know-how, can't create a single dollar of profit—not until something is sold. And selling, in our economy, is a mass production job!

Advertising simply provides the necessary machinery. It is the application of assembly line methods to the

manufacture of a sale. For sales don't just "happen."
Like any other commodity, they require a series of
processing operations. Usually, it takes five:

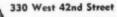
- 1. Seeking out prospects
- 2. Arousing their interest
- 3. Creating a preference for your product
- 4. Making a specific proposal
- 5. Closing the order

By mechanizing the first three of these operations, advertising enables your salesmen to concentrate on the two jobs which they alone can do, and do best. And nowhere does the machinery of advertising work more efficiently than in the business press, where it reaches the greatest number of interested prospects, at the lowest possible cost.

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With Chemical & Metallurgical Engineering
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New York 18, New York

THE ASSOCIATED BUSINESS PAPERS 205 East 42nd Street, New York 17, N. Y.

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CORNING MULTIFORM GLASS

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To Your Processing Requirements!

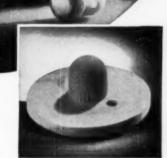
GIVES YOU ALL THE ADVANTAGES
OF PYREX brand GLASS

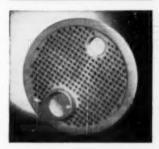
Here is a new material of construction for plant processing equipment which may be the answer to lower costs in many phases of your plant processing cycle. Possessing all the advantages inherent in PYREX brand glass No. 7740, it can be molded into many shapes not possible by pressing, blowing, and drawing glassware. Note the examples illustrated.

Corning MULTIFORM Glass is equally as stable as PYREX. It withstands thermal and physical shock to the same degree. It is highly resistant to all acids and mild alkalies. It is non-porous. It can be obtained as an opaque white, glazed or unglazed material.

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Look for the Corning exhibit... Chemical Industries Exposition Grand Central Palace, Week of Nov. 25th









7

PLANT EQUIPMENT SALES DEPARTMENT

CORNING GLASS WORKS, CORNING, N. Y.

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Exactly 10 years ago the Navy purchased its first Dempster-Dumpster equipment . . . one truck hoisting unit with several containers. Now there are dozens of hoisting units and thousands of Dempster-Dumpster containers of many types at work keeping Navy yards and stations "ship shape." The sturdy steel foolproof and fireproof containers are placed at various places, such as barracks, mess

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If you have a materials handling problem demanding more cleanliness, more economy, and more efficiency, it will pay you to investigate the Dempster-Dumpster System—popularly used, not only by the armed forces, but by municipalities, leading industrial plants, and by large and small institutions of all kinds.



Photo above shows eleven holisting units recently delivered to the U. S. Nevy. Various types of containers are shown in carrying positions. Photo at left shows a holisting unit preparing to lift a 10 cu. yd. Flat Top container, while another holisting unit is dumpling a 7 cu. yd. Trash and Rubbith Kolecho type container. All controls of unit are conveniently located at the driver's seat. One driver and one truck handles any number of containers regardless of types.



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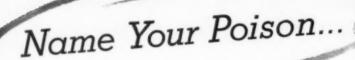
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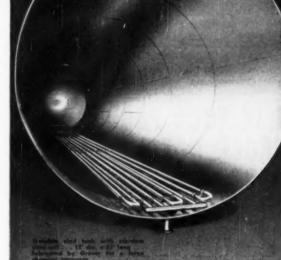
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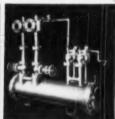
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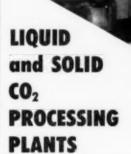


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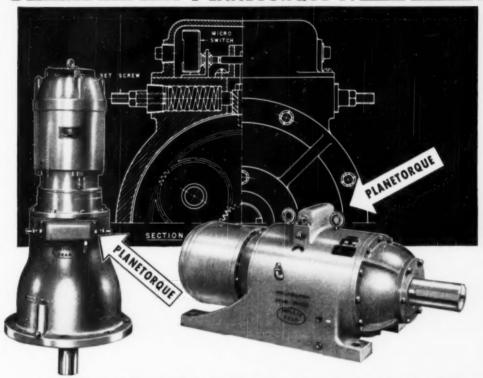


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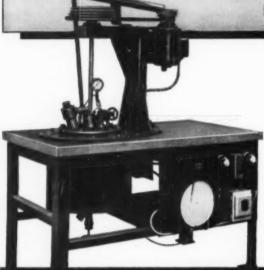
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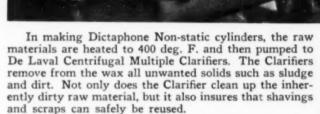


October 1949—CHEMICAL ENGINEERING

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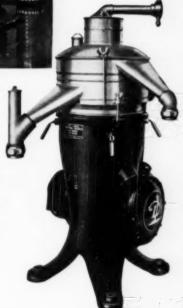
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Porosity is defined as the percentage ration of pore space by volume to the bulk volume of the piece. There are three types of pores: open, closed and closed at one end. Obviously, only the open pores have capacity to pass air or gas through the medium.

All ALUNDUM porous mediums have substantially the same pore volume. The size and number of open pores are varied to provide the desired permeabilities.

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### permeability

It is of primary importance that each porous medium be uniformly permeable and this uniformity is successfully met by Norton Company's "controlled structure" process of manufacture. Permeability is defined as the amount of air, at  $70^\circ$  F. and 25% relative humidity, which will pass through an area of one square foot of dry porous plate or tube in one minute when tested under an equivalent pressure differential of two inches of water.

Recently, higher permeability ratings of from 40 to 120 cubic feet have been found more suitable. The reasons for this trend toward coarser mediums (larger pore diameters) are: less clogging, longer life, lower wet pressure loss (and in some operations a substantial power saving in air delivery).

ALUNDUM porous mediums can be made to offer minimum wet pressure loss for any given permeability.

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For all practical purposes, in commercial and laboratory processes, Norton porous mediums are unaffected by the acid, neutral and slightly alkaline conditions encountered.

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Norton porous mediums are exceedingly refractory. Temperatures up to 1000° C., properly applied, have no effect upon their physical structure. Mediums clogged with organic matter are, therefore, easily cleaned by burning.

### strength

Because of their great strength ALUNDUM porous mediums operate under high pressures, reduce materially breakage and chipping in handling, and they remain extremely resistant to abrasion.

Tests run on standard plates show strengths sufficient to support loads many times those usually encountered. The table below gives results of typical tests on ALUNDUM plates of various permeabilities:

### physical structure

| permeability of<br>dry plate,<br>cu ft/min/sq ft/<br>in, thick./at 2 in. | average<br>modulus of<br>rupture, psi |      | breaking load when<br>wet plate is sup-<br>ported on four sides<br>with ½-in, bearing |          |
|--|---------------------------------------|------|---|----------|
| water pressure   | dry                                   | wet  | ft of water   | #/sq. in |
| 121.0  | 1670                                  | 1465 | 97  | 42       |
| 80.9   | 1950                                  | 1685 | 110   | 48       |
| 37.8   | 2684                                  | 2235 | 147   | 64       |
| 16.9   | 3045                                  | 2644 | 175   | 76       |
| 4.1  | 3770                                  | 3716 | 246   | 107      |

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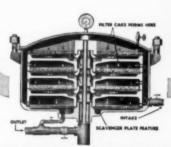
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- 1—J. H. Day double arm, jacketed mixer, sigma blades, 500 gallons.

  1—Baker Perkins double arm jacketed Mixer, 2000 gallons.

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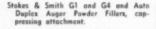
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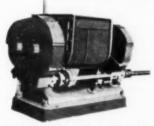
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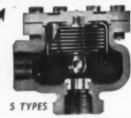
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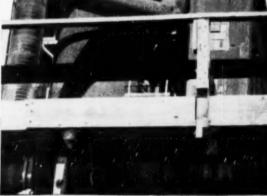
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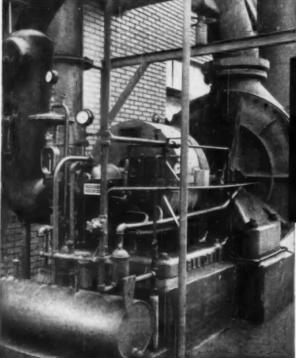


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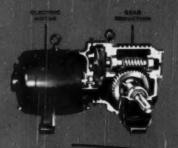
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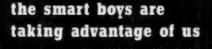
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